POWER

SYMBOL	DESCRIPTION
2#6, 1#6, 1#10 XX-#2.4	CONDUIT AND WIRE HOMERUN 'XX' INDICATES PANEL DESIGNATION. '#2.4' INDICATES CIRCUIT NUMBER(S). PROVIDE WIRING AS INDICATED (HOT CONDUCTOR(S), NEUTRAL, GROUND). MINIMUM 2#12 & 1#12 GND THWN IN 3/4" CONDUIT.
	RISER CONDUIT UP, WITH WIRING.
	RISER CONDUIT DOWN, WITH WIRING.
J	CEILING MOUNTED JUNCTION/SPLICE BOX, SIZE AS REQUIRED.
HJ	WALL MOUNTED JUNCTION/SPLICE BOX, SIZE AS REQUIRED.
	SURFACE MOUNTED ELECTRICAL EQUIPMENT (SWITCHBOARD, PANELBOARD)
	RECESSED ELECTRICAL EQUIPMENT (PANELBOARD)
S^{a}	SINGLE POLE TOGGLE SWITCH, FLUSH MOUNTED AT 4'-0." SUPERSCRIPT DENOTES FIXTURES CONTROLLED. '3' INDICATES THREE-WAY SWITCH. '4' INDICATES FOUR-WAY SWITCH. 'MC' INDICATES SINGLE OR MULTI-BUTTON MOMENTARY CONTACT SWITCH FOR CEILING MOUNTED SENSOR OVERRIDE.
S_K	SINGLE POLE KEY OPERATED TOGGLE SWITCH, FLUSH MOUNTED AT 4'-0" AFF.
S_M	MANUAL MOTOR STARTER TOGGLE SWITCH FOR FRACTIONAL HORSEPOWER MOTOR.
S_{AT}	ASTRONOMICAL TIMER
$S_{R/L}$	RAISE/LOWER SWITCH FOR CONTROL OF MOTORIZED SHADES
D_{MS}	CEILING-MOUNTED JUNCTION BOX FOR POWER CONNECTION TO MOTORIZED SHADES. COORDINATE CONNECTIONS WITH MANUFACTURER.
LD	LEAK DETECTOR AND SOLENOID VALVE. CONTRACTOR SHALL PROVIDE POWER CONNECTION TO LEAK DETECTOR AND SOLENOID VALVE. CONTRACTOR SHALL PROVIDE POWER CONNECTION TO CONNECT 'PR-WM' DEVICE. COORDINATE WITH MECHANICAL/PLUMBING CONTRACTOR. SEE ELECTRICAL AND PLUMBING DRAWING DETAILS FOR ADDITIONAL INFORMATION.
A#5,7,9 E#1	CEILING SERVICE PANEL FEED FOR LABORATORY EQUIPMENT. COORDINATE WITH LAB EQUIPMENT PLANS TO PROVIDE QUANTITY AND TYPES OF DEVICES AS REQUIRED. 'A#5,7,9' AND 'E#1' INDICATE PANEL AND CIRCUIT NUMBERS OF RECEPTACLES INSTALLED.
5 GFI 5 GFI	DUPLEX THREE-WIRE GROUNDED RECEPTACLE, 20A, 125V, MOUNTED AT 18" AFF. CENTER FILLED SYMBOL INDICATES DEDICATED CIRCUIT. SUBSCRIPT 'F' INDICATES FURNITURE MOUNTED. 'USB' INDICATES RECEPTACLE WITH USB PROVISIONS. 'GFI' INDICATES GROUND FAULT INTERRUPTER. 'CP' INDICATES CONDENSATE PUMP, MOUNT AS REQUIRED FOR PUMP. NUMERAL INDICATES CIRCUIT NUMBER.
5 GFI 5 GFI	DUPLEX THREE-WIRE GROUNDED RECEPTACLE, 20A, 125V, MOUNTED ABOVE CASEWORK. REFER TO ARCHITECTURAL DRAWINGS FOR EXACT HEIGHT. SUBSCRIPT 'F' INDICATES FURNITURE MOUNTED. 'GFI' INDICATES GROUND FAULT INTERRUPTER. NUMERAL INDICATES CIRCUIT NUMBER.
5 TP	DUPLEX RECEPTACLE FOR POWER CONNECTION TO FLOOR DRAIN TRAP PRIMER. COORDINATE EXACT LOCATION AND CONNECTION REQUIREMENTS WITH PLUMBING CONTRACTOR. NUMERAL INDICATES CIRCUIT NUMBER.
5 B	WALL MOUNTED SPECIAL RECEPTACLE. 250V, 2P, 3W, GROUNDED. NUMERAL INDICATES CIRCUIT NUMBER. LETTER INDICATES AMPERE RATING: 'A' - (20A) NEMA 6-20R 'B' - (20A) NEMA 6-20R 'C' - (30A) NEMA 6-30R
5,7,9 B	WALL MOUNTED, LOCKING TYPE SPECIAL RECEPTACLE. 250V, 3P, 4W, GROUNDED. NUMERALS INDICATES CIRCUIT NUMBERS. LETTER INDICATES AMPERE RATING: 'A' - (20A) NEMA L15-20R 'B' - (30A) NEMA L15-30R 'C' - (50A) NEMA L15-50R
5	FLUSH FLOOR MOUNTED CAST COMBINATION FLOOR BOX. PROVIDE COMBINATION/TYPE OF RECEPTACLES, TELECOMMUNICATION DEVICES, AND AV DEVICES AS SPECIFIED BY ARCHITECT. CONTRACTOR TO TRENCH FLOOR AND PROVIDE CONDUIT(S) FOR POWER, TEL/DATA, AND AV CABLING AS PER DETAIL ON E501.
1,3,5 GFI	WALL-MOUNTED, PLUG-IN RACEWAY ASSEMBLY (STARLINE BY LEGRAND). PROVIDE DUAL RACEWAY FOR POWER AND DATA WIRING. 'GFI' INDICATES REQUIRED GROUND FAULT INTERRUPTING DEVICE. NUMERALS INDICATE CIRCUIT NUMBERS.
5 GFI	DUPLEX THREE-WIRE GROUNDED RECEPTACLE, 20A, 125V, FLOOR-MOUNTED, PEDESTAL TYPE. 'GFI' INDICATES GROUND FAULT INTERRUPTING DEVICE. NUMERAL INDICATES CIRCUIT NUMBER.
TV	WALL MOUNTED COMBINATION POWER AND DATA TV BACK BOX WITH 1-1/4" EMPTY CONDUIT WITH DRAG WIRE STUBBED 6" ABOVE NEAREST ACCESSIBLE HUNG CEILING AND TERMINATED WITH BUSHING. FSR MODEL #PWB-320 OR APPROVED EQUAL PROVIDE QUADRUPLEX RECEPTACLE IN BACK BOX - 20A, 125V, 1P, 3W, GROUNDED, NEMA 5-20R
HJ	JUNCTION BOX FOR CONNECTION TO HVAC EQUIPMENT. PROVIDE MANUAL MOTOR STARTER WITH THERMAL OVERLOAD AND PILOT LIGHT FOR LOCAL EQUIPMENT DISCONNECT.
	CONNECT TO GROUND.
30AS/15AF	FUSED DISCONNECT SWITCH, RATING AND FUSING AS NOTED. HORSEPOWER RATING AS REQUIRED BY MOTOR LOAD. 'WP' INDICATES WEATHERPROOF ENCLOSURE, OTHERWISE NEMA-1. RATING SAME OR HIGHER THEN UPSTREAM CIRCUIT PROTECTIVE DEVICE U.O.N.
30A	UNFUSED DISCONNECT SWITCH, RATING AS NOTED. 'WP' INDICATES WEATHERPROOF ENCLOSURE, OTHERWISE NEMA-1. RATING SAME OR HIGHER THEN UPSTREAM CIRCUIT PROTECTIVE DEVICE U.O.N.
GPB	EMERGENCY GAS SHUTOFF MUSHROOM TYPE PUSHBUTTON SWITCH OFF ONLY. MOUNTED AT 4'-0" AFF.
EPB	EMERGENCY POWER SHUTOFF MUSHROOM TYPE PUSHBUTTON SWITCH OFF ONLY. MOUNTED AT 4'-6" AFF.
CS	EMERGENCY POWER SHUTOFF WITH KEY ON AND PUSHBUTTON SWITCH OFF. MOUNTED AT 4'-6" AFF.
GS	EMERGENCY GAS SHUTOFF SWITCH WITH KEY ON AND PUSHBUTTON OFF. MOUNTED AT 4'-0" AFF.
BG	BREAK GLASS "OFF" SWITCH, MOMENTARY CONTACT TYPE, LABELED "EMERGENCY OFF". FLUSH MOUNTED AT 4'-0" AFF.
	GROUNDING BUSBAR
	UNFUSED SWITCH
	AUTOMATIC TRANSFER SWITCH
M	CURRENT TRANSFORMER AND METER

TELECOMMUNICATIONS SYSTEM

SYMBOL	DESCRIPTION
	TELEPHONE/DATA OUTLET WITH ONE (1) TELEPHONE JACK AND ONE (1) DATA JACK LABELED 'TEL' AND 'DATA,' FLUSH MOUNTED AT 18" AFF.
	DATA OUTLET WITH SINGLE JACK LABELED 'DATA', FLUSH MOUNTED AT 18" AFF.
FP	TELEPHONE / DIRECT LINE FOR FIRE PUMP TERMINATED IN RJ31X.
M	MANHOLE SIZE PER NEC REQUIEMENTS.

LIGHTING

SYMBOL	DESCRIPTION
A c 3	CEILING-MOUNTED OR RECESSED LIGHTING FIXTURE. SUBSCRIPT 'A' DENOTES FIXTURE TYPE. SUPERSCRIPT 'c' DENOTES SWITCH CONTROL. NUMERAL DENOTES CIRCUIT NUMBER.
A EM 3	CEILING-MOUNTED OR RECESSED EMERGENCY LIGHTING FIXTURE. SUPERSCRIPT 'A' DENOTES FIXTURE TYPE. NUMERAL DENOTES CIRCUIT NUMBER. 'EM' INDICATES EMERGENCY FIXTURE WITH LOCAL SWITCH CONTROL. 'EM/NL' INDICATES UNSWITCHED FIXTURE.
G	WALL MOUNTED EXIT SIGN. DIRECTIONAL ARROWS INDICATED ON PLANS. SHADING INDICATES WHERE 'EXIT' LETTERING APPEARS. SUBSCRIPT 'D' INDICATES EXIT FOR DISABLED. SUPERSCRIPT 'G' DENOTES WITH GUARD.
G	CEILING MOUNTED EXIT SIGN. DIRECTIONAL ARROWS INDICATED ON PLANS. SHADING INDICATES WHERE 'EXIT' LETTERING APPEARS. SUBSCRIPT 'D' INDICATES EXIT FOR DISABLED. SUPERSCRIPT 'G' DENOTES WITH GUARD.
S_{OS}	WALL MOUNTED OCCUPANCY SENSOR (AUTO ON).
OS	CEILING MOUNTED OCCUPANCY SENSOR (AUTO ON). REFER TO DETAIL ON E504 FOR ADDITIONAL INFORMATION.
PS	CEILING MOUNTED PHOTOCELL
CP	CEILING MOUNTED OCCUPANCY SENSOR FOR AFTER-HOURS OVERRIDE OF LIGHTING CONTROL PANEL. REFER TO DETAIL ON E504 FOR ADDITIONAL INFORMATION.
MPS	CEILING MOUNTED SENSOR FOR MOVABLE PARTITION
RC	ROOM CONTROLLER FOR LOW VOLTAGE LIGHTING CONTROL. MOUNT TO JUNCTION BOX. REFER TO DETAIL ON E501 FOR ADDITIONAL INFORMATION.
S	LOW VOLTAGE SWITCH FOR MANUAL CONTROL OF ROOM CONTROLLER.
D	LOW VOLTAGE DIMMER FOR MANUAL CONTROL OF ROOM CONTROLLER.
C	LOW VOLTAGE SCENE SWITCH FOR MANUAL CONTROL OF ROOM CONTROLLER.

MISCELLANEOUS

SYMBOL	DESCRIPTION
DETAIL ENLARGED PLAN, ETC REFERENCE X EXXX	X - PART PLAN NUMBER EXXX - DRAWING NUMBER

ABBREVIATIONS

A	AMPERE
AC	ALTERNATING CURRENT
AFF	ABOVE FINISHED FLOOR
ARCH	ARCHITECTURAL
ATS	AUTOMATIC TRANSFER SWITCH
A/C	AIR CONDITIONING
BT	BOOK THEFT
C	CONDUIT
CAB	CABINET
CAT	CATEGORY
CLG	CEILING
CB	CIRCUIT BREAKER
CKT(S)	CIRCUIT(S)
CM	CONTROL MODULE
COL	COLUMN
CSB	CABLE SUPPORT BOX
DEM	DEMOLISH - DISCONNECT AND REMOVE
DWG	DRAWING
DP	DISTRIBUTION PANEL (208/120V)
E	EXISTING TO REMAIN
EC	EMPTY CONDUIT
ELEC	ELECTRIC
EM	EMERGENCY
EMR	ELEVATOR MECHANICAL ROOM
EP	EXPLOSION PROOF
ER	EXISTING TO REMAIN
ETR	EXISTING TO BE RELOCATED
EXH	EXHAUST
EXIST	EXISTING
EWC	ELECTRIC WATER COOLER
FL	FLOOR
FO	FIBER OPTIC
FOPP	FIBER OPTIC PATCH PANEL
FASS	FIRE ALARM SERVICE SWITCH
FRE	FIBERGLASS REINFORCED EXPOXY CONDUIT
FP	FIRE PUMP
FPSS	FIRE PUMP SERVICE SWITCH
G	GUARD
GND	GROUND
GFI	GROUND FAULT INTERRUPTER
GRC	GALVANIZED RIGID CONDUIT
IDF	INTERMEDIATE DISTRIBUTION FRAME
IG	ISOLATED GROUND
JB	JUNCTION BOX
KVA	KILOVOLT AMPERE
KW	KILOWATT
KWH	KILOWATT HOUR
LDF	LOCAL DISTRIBUTION FRAME
LP	LIGHTING PANEL
LS	LOUDSPEAKER
LSS	LOCAL SOUND SYSTEM
LTG	LIGHTING
LVRC	LOW VOLTAGE RELAY CONTROL
MATV	MASTER TELEVISION
MCC	MOTOR CONTROL CENTER
MDF	MAIN DISTRIBUTION FRAME
MECH	MECHANICAL
MER	MECHANICAL EQUIPMENT ROOM
MIC	MICROPHONE
MSB	MAIN SWITCHBOARD
MSSB	MAIN SERVICE SWITCHBOARD
MTD	MOUNTED
MDR	MAIN DISTRIBUTION ROOM
N	NEUTRAL
NIC	NOT IN CONTRACT
NC	NORMALLY CLOSED
NL	NIGHT LIGHT
N.O.	NORMALLY OPEN
P	POLE(S)
PB	PULL BOX
P&D	PLUMBING AND DRAINAGE
PNL	PANEL
PP	POWER PANEL
PR	PAIR
R	TO BE REMOVED
REL	RELOCATE
RC	REMOTE CONTROL
RGS	RIGID GALVANIZED STEEL CONDUIT
RP	RECEPTACLE PANEL
SE	SERVICE ENTRANCE
SOC	SCHOOL OPERATING CONSOLE
SP	SPARE
SSB	SOLID STATE BALLAST
STD	STANDARD
SW	SWITCH
SWBD	SWITCHBOARD
TCC	TEMPERATURE CONTROLS CONTRACTOR
TC	TELECOMMUNICATION CLOSET
TEL	TELEPHONE
TGB	TELECOMMUNICATION GROUNDING BUS BAR
TMGB	TELECOMMUNICATION MAIN GROUNDING BUS BAR
TV	TELEVISION
TYP	TYPICAL
UG	UNDER GROUND
UON	UNLESS OTHERWISE NOTED
UTP	UNSHIELDED TWISTED-PAIR
V	VOLT
W	WATT
WP	WEATHERPROOF WHILE IN USE ENCLOSURE

ELECTRICAL GENERAL NOTES

1. COORDINATE WITH OTHER TRADES TO DETERMINE THE EXACT LOCATION OF MOTORS, MOTOR TERMINAL BOXES, AND OTHER EQUIPMENT TO BE INSTALLED BY OTHER TRADES BEFORE CONDUIT WORK IS STARTED. REFER TO MECHANICAL, PLUMBING, AND FIRE PROTECTION DRAWINGS FOR LOCATIONS OF ALL EQUIPMENT.
2. CONTRACTOR SHALL PROVIDE AND CONNECT ALL RACEWAYS AND WIRING FROM EQUIPMENT, DEVICES, AND LIGHTING FIXTURES TO ITS SOURCE OF POWER AND CONTROLS.
3. COORDINATE LOCATION OF OUTLETS AND SWITCHES WITH FURNITURE AND EQUIPMENT LAYOUTS AND WITH OWNER'S REPRESENTATIVE.
4. WHERE MULTIPLE SWITCHES AND RECEPTACLES ARE INDICATED AT THE SAME LOCATION, THEY SHALL BE MOUNTED BEHIND A COMMON FACEPLATE.
5. MOUNTING HEIGHTS OF EQUIPMENT AND DEVICES SHALL BE AS INDICATED ON THE ARCHITECTURAL DRAWINGS. WHERE MOUNTING HEIGHTS ARE NOT GIVEN ON THE ARCHITECTURAL DRAWINGS, UTILIZE THE FOLLOWING MOUNTING HEIGHTS UNLESS OTHERWISE NOTED (ALL DIMENSIONS TO CENTERLINE OF BOX):
   - A. RECEPTACLES (WALL MOUNTED) - 18" AFF
   - B. RECEPTACLES (COUNTER HEIGHT) - HORIZONTAL 6" ABOVE COUNTER
   - C. FURNITURE FEEDS (WALL MOUNTED) - SAME HEIGHT AS RECEPTACLES
   - D. TELEPHONE/DATA OUTLETS - SAME HEIGHT AS RECEPTACLES (WALL MOUNTED)
   - E. WALL MOUNTED TELEPHONES - 48" AFF
   - F. LIGHTING SWITCHES AND CONTROLS - 48" AFF
   - G. LIGHTING FIXTURES (AREAS WITHOUT CEILINGS) - 9'-6" AFF
   - H. FIRE ALARM AUDIO/VISUAL AND STROBE UNITS - 80" AFF
   - I. MANUAL FIRE ALARM STATIONS - 48" AFF
   - J. PANELBOARDS AND CABINETS - 78" TO TOP OF ENCLOSURE
6. WHERE EQUIPMENT, LIGHTING FIXTURES, AND WIRING DEVICES ARE SHOWN WITH CIRCUIT NUMBERS ONLY, THE MINIMUM BRANCH CIRCUITING REQUIREMENTS SHALL BE AS FOLLOWS:
   - A. IN ACCORDANCE WITH N.E.C. ARTICLE 210.4 (B), CONTRACTOR SHALL PROVIDE SEPARATE NEUTRAL CONDUCTORS FOR EACH PHASE CONDUCTOR OF SINGLE PHASE LIGHTING OR RECEPTACLE BRANCH CIRCUITS, OR PROVIDE MULTI-POLE CIRCUIT BREAKERS IN PANELBOARDS WHERE USING A COMMON NEUTRAL FOR TWO OR THREE, SINGLE PHASE CIRCUIT HOMERUNS.
   - B. LIGHTING FIXTURES - 2 #12, #12 GRD. - 3/4" C.
   - C. RECEPTACLES - 2#12, #12 GRD. - 3/4" C.
   - D. BRANCH CIRCUIT BREAKERS (277 VOLT) - 1P, 20A
   - E. BRANCH CIRCUIT BREAKERS (120 VOLT) - 1P, 20A
   - F. HOMERUNS TO PANELBOARDS SHALL CONTAIN NO MORE THAN (3) CIRCUITS.
   - G. 208/120 VOLT 480/277 VOLT WIRING SHALL BE RUN IN SEPARATE RACEWAY SYSTEMS.
   - H. STANDBY SERVICES SHALL BE RUN IN SEPARATE RACEWAYS FROM ALL OTHER SYSTEMS.
7. WHERE CONDUIT AND WIRING CONNECTIONS ARE NOT SHOWN ON THE PLANS, MAKE CONNECTIONS AS FOLLOWS:
   - A. USE #10 AWG WIRE TO THE FIRST AND ANY OUTLET FOR BRANCH CIRCUIT RUNS MORE THAN 80 FEET FOR 120V AND 208V CIRCUITS, U.O.N.
   - B. USE #10 AWG WIRE TO THE FIRST AND ANY OUTLET FOR BRANCH CIRCUIT RUNS MORE THAN 150 FEET FOR 265V AND 460V CIRCUITS, U.O.N.
8. ALL BRANCH CIRCUIT WIRING SHALL BE RUN CONCEALED IN WALLS AND/OR ABOVE HUNG CEILING UNLESS OTHERWISE NOTED.
9. NO LOW VOLTAGE WIRING SHALL BE PERMITTED IN THE SAME RACEWAY AS POWER WIRING.
10. CONTRACTOR TO DE-RATE CONDUCTORS IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE WHEN INSTALLING MORE THAN THREE (3) CIRCUITS IN A 3/4"C HOMERUN.
11. PROVIDE DRAG LINES IN ALL EMPTY RACEWAYS.
12. CONTRACTOR SHALL PROVIDE AN EMPTY CONDUIT SYSTEM WITH DRAG LINES AND OUTLET BOXES FOR INSTALLATION OF LOW TENSION WIRING SYSTEM. VERIFY EXACT REQUIREMENTS WITH SYSTEM VENDOR.

ELECTRICAL CODES AND STANDARDS

DESIGN AND PERFORMANCE OF COMPONENTS AND METHODS SPECIFIED HEREIN SHALL COMPLY WITH THE APPLICABLE PROVISIONS OF THE CODES, STANDARDS, AND MANUFACTURER'S RECOMMENDATIONS OF THE ENTITIES LISTED BELOW:

1)	BUILDING	FACILITY MANAGEMENT STANDARDS FOR ALTERATIONS AND CONSTRUCTION
2)	BC	2018 NORTH CAROLINA BUILDING CODE
3)	ECC	2018 NORTH CAROLINA ENERGY CONSERVATION CODE
4)	ASHRAE	AMERICAN SOCIETY OF HEATING, REFRIGERATION AND AIR-CONDITIONING ENGINEERS
5)	ASTM	AMERICAN SOCIETY FOR TESTING MATERIALS
6)	ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
7)	UL	UNDERWRITER'S LABORATORIES, INC
8)	FM	FACTORY MUTUAL
9)	NFPA	NATIONAL FIRE PROTECTION ASSOCIATION

Estimated Load Summary

Load Type	Connected Load (kVA)	Demand Load (kVA)
A/C or Heat Pumps	585	585
Heat Strip	211	211
Lighting	74	74
Refrigeration	11	11
Water Heating	60	60
Miscellaneous	52	52
Receptacles	477	244
Total	**1470**	**1237**

Power Factor = 0.9

THE CONSTRUCTION SHALL FOLLOW THE HIERARCHY OF HAZARD CONTROL MEASURES FROM ANSI Z10 AMERICAN NATIONAL STANDARD FOR OCCUPATIONAL HEALTH SAFETY AND MANAGEMENT SYSTEMS WHICH IN DECREASING ORDER OF SAFETY CONTROL EFFECTIVENESS ARE: ELIMINATION, SUBSTITUTION, ENGINEERING CONTROLS, WARNINGS, ADMINISTRATIVE CONTROLS, AND PERSONAL PROTECTIVE EQUIPMENT (PPE). (2020 SCO ELECTRICAL GUIDELINES AND POLICIES SECTION 26 01 00)

CLIENT AND PROJECT

DURHAM TECH

DURHAM TECH COMMUNITY COLLEGE

LIFE SCIENCES BUILDING

1650 E Lawson St.
Durham, NC 27703

SCO ID: 23-26245-02B
NCCCS ID: 2731

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05-07-2025

ISSUE

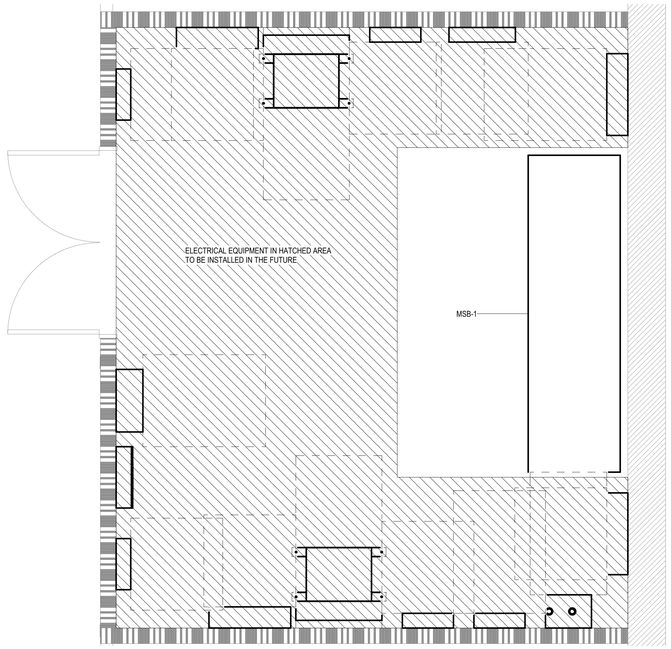
No.	Date	Description

SHEET INFO

EARLY PACKAGE ELECTRICAL NOTES, SYMBOLS LIST & ABBREVIATIONS

EP-E001

PROJECT NO: 13774-000
DATE: 05/07/2025
EARLY EQUIPMENT PACKAGE



1 MAIN ELECTRICAL ROOM PART PLAN
1/2" = 1'-0"

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05-07-2025

ISSUE

No.	Date	Description

SHEET INFO

EARLY PACKAGE ELECTRICAL PART PLANS

EP-E300

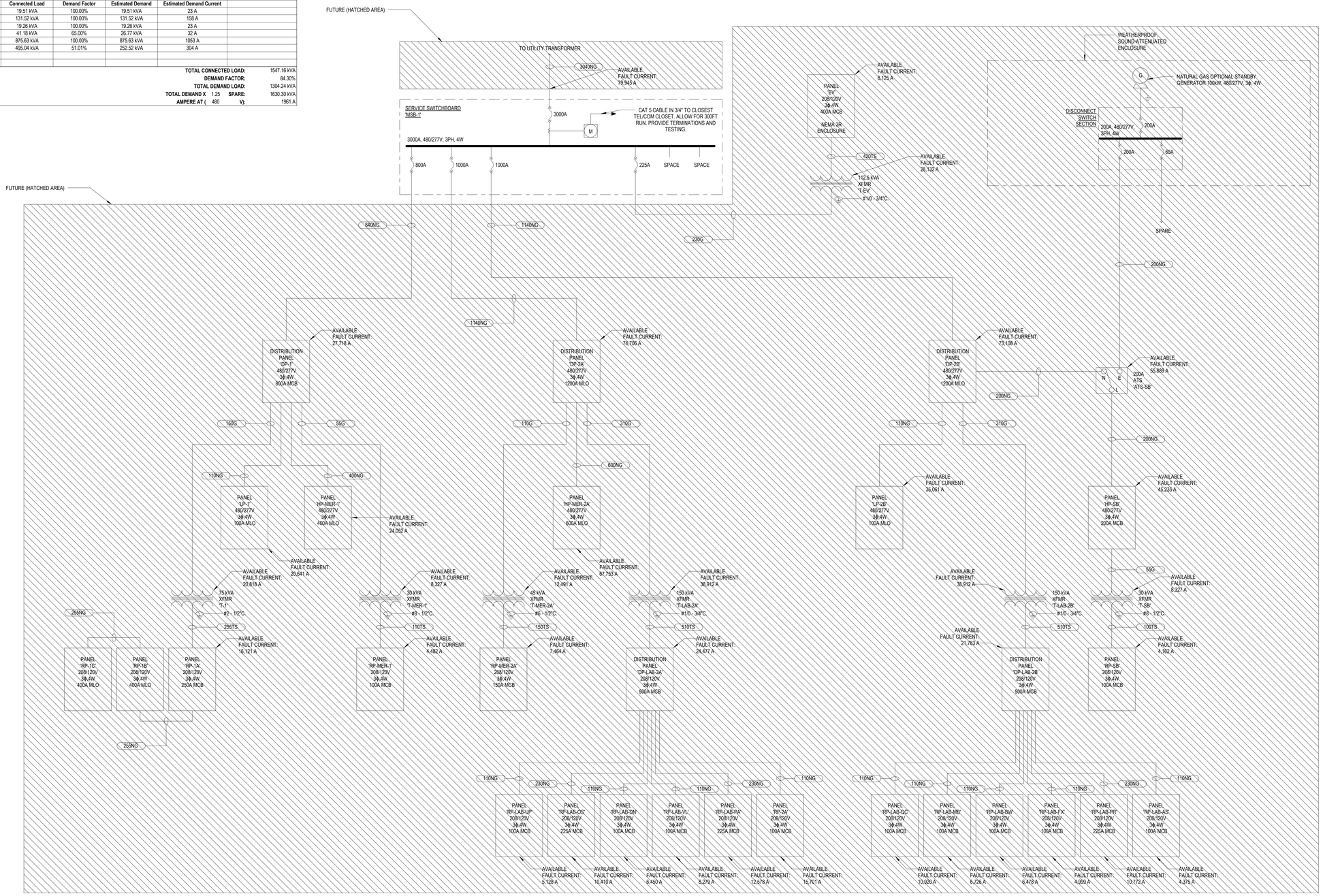
PROJECT NO: 13774-000
DATE: 05/07/2025
EARLY EQUIPMENT PACKAGE

LOCATION: MAIN ELECTRICAL 207			REMARKS:	PANEL DESIGNATION:
SERVICE: 480/277 V	3 - PHASE			MSB-1
MAINS: 3000 A MCB	4 - WIRE			
MOUNTING: FLOOR	GROUNDING:			
NEUTRAL: Yes	GROUND BUS: Yes			
	AIC RATING: 100K			

CKT #	TYPE	SWITCH/ FRAME (AMP)	POLES	FUSE / TRIP (AMP)	FEEDER	SERVICE	REMARKS	TOTAL CONNECTED LOAD
1	CB	800 A	3	800 A	2 SETS OF (4-500kcmil, 1#1/0G,...	DISTRIBUTION PANEL DP-1		288.24 kVA
2	CB	1200 A	3	1000 A	3 SETS OF (4-500kcmil, 1#2/0G,...	DISTRIBUTION PANEL DP-2A		639.46 kVA
3	CB	1200 A	3	1000 A	3 SETS OF (4-500kcmil, 1#2/0G,...	DISTRIBUTION PANEL DP-2B		572.32 kVA
4	CB	250 A	3	225 A	3#4/0, 1#4G, 2-1/2"C.	PANEL EV (VIA XFMR)		53.25 kVA
5	--	--	3	--	--	SPACE		--
6	--	--	3	--	--	SPACE		--

Load Classification	Connected Load	Demand Factor	Estimated Demand	Estimated Demand Current
Motor	19.51 kVA	100.00%	19.51 kVA	23 A
Other	131.52 kVA	100.00%	131.52 kVA	158 A
Lighting	19.26 kVA	100.00%	19.26 kVA	23 A
Kitchen Equipment	41.18 kVA	65.00%	26.77 kVA	32 A
HVAC	875.63 kVA	100.00%	875.63 kVA	1053 A
Receptacle	495.04 kVA	51.01%	252.52 kVA	304 A

TOTAL CONNECTED LOAD:		1547.16 kVA
DEMAND FACTOR:		84.30%
TOTAL DEMAND LOAD:		1304.24 kVA
TOTAL DEMAND X 1.25	SPARE:	1630.30 kVA
AMPERE AT (480	V):	1961 A



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05-07-2025

ISSUE

No.	Date	Description

SHEET INFO

EARLY PACKAGE ELECTRICAL SINGLE LINE DIAGRAM

EP-E401

PROJECT NO: 13774-000
DATE: 05/07/2025
EARLY EQUIPMENT PACKAGE

SYMBOLS

	FIRE DAMPER (FD) W/ ACCESS DOOR
18x12	DUCT SIZE (FIRST FIGURE INDICATES PLAN SIZE)
	SUPPLY DUCT UP (DISCHARGE SIDE OF FAN)
	SUPPLY DUCT DOWN (DISCHARGE SIDE OF FAN)
	RETURN OR EXHAUST DUCT UP (SUCTION SIDE OF FAN)
	RETURN OR EXHAUST DUCT DOWN (SUCTION SIDE OF FAN)
	ACOUSTIC LINING IN DUCT
	FLEXIBLE CONNECTION
	ELBOW WITH TURNING VANES
	RADIUS ELBOW
	VOLUME DAMPER W/DUCT ACCESS DOOR
	VARIABLE AIR VOLUME TERMINAL UNIT
	MOTORIZED DAMPER W/DUCT ACCESS DOOR
	ACCESS DOOR IN DUCT
R	SLOPING RISE IN DUCT IN DIRECTION OF ARROW
D	SLOPING DROP IN DUCT IN DIRECTION OF ARROW
	SUPPLY DIFFUSER
	SUPPLY DIFFUSER - 3 WAY, 2 WAY, 1 WAY
ACTIVE SECTION / INACTIVE SECTION	LINEAR SUPPLY DIFFUSER
	ACOUSTICAL LINING
	SPIRAL DOUBLE WALL WITH INSULATION
	NEW WORK
T	THERMOSTAT
OC	OCCUPANCY COUNTER
	POINT OF NEW CONNECTION TO EXISTING WORK
	POINT OF DISCONNECTION
S	SMOKE DETECTOR
P	STATIC PRESSURE SENSOR
M	AIR MEASURING DEVICE/AIR FLOW STATION
TT	TEMPERATURE TRANSMITTER SENSOR
	RETURN AIR GRILLE
	EXISTING WORK TO BE REMOVED
	EXISTING WORK TO REMAIN
RS	REFRIGERANT LINE SUPPLY
RL	REFRIGERANT LINE RETURN
CWS	CONDENSER WATER SUPPLY
CWR	CONDENSER WATER RETURN
CHWS	CHILLED WATER SUPPLY
CHWR	CHILLED WATER RETURN
HWS	HOT WATER SUPPLY
HWR	HOT WATER RETURN
GS	NATURAL GAS SUPPLY
GR	NATURAL GAS RETURN
	WIRE MESH SCREEN
	WALL TRANSFER GRILLE
	AREA NOT IN SCOPE OF WORK
	FLEX DUCT

PIPING, VALVES AND GAUGES

	GLOBE VALVE
	GATE VALVE
	CHECK VALVE
	AUTOMATIC TWO-WAY CONTROL VALVE
	BALL VALVE
	THERMOMETER
	PRESSURE GAUGE; GAUGE COCK
	MANUAL AIR VENT
	AUTOMATIC AIR VENT
	ARROW INDICATES DIRECTION OF FLOW
	UNION
	CAPPED PIPE
	"Y" TYPE STRAINER WITH CAPPED BLOWDOWN VALVE
	ELBOW TURNED UP
	ELBOW TURNED DOWN
	TEE DOWN CONNECTION
	TEE UP CONNECTION

MECHANICAL ABBREVIATIONS

AD	ACCESS DOOR	LE	LAB EXHAUST
AFF	ABOVE FINISHED FLOOR	LD	LINEAR DIFFUSER
AL	ACOUSTICAL LINING	LPS	LOW PRESSURE STEAM
AHU	AIR HANDLING UNIT	LPR	LOW PRESSURE STEAM CONDENSATE RETURN
BG	BOTTOM GRILLE	MBH	THOUSAND BTU'S PER HOUR
BN	BOTTOM NECK	NK	NECK (AS RELATED TO DUCT & DIFFUSER)
CAV	CONSTANT AIR VOLUME	NIC	NOT IN THIS CONTRACT
CB	CHILLED BEAM	NTS	NOT TO SCALE
CC	COOLING COIL	NC	NORMALLY CLOSED
CD	CEILING DIFFUSER	NO	NORMALLY OPEN
CG	CEILING GRILLE	OAD	OUTSIDE AIR DAMPER
CHW	CHILLED WATER	OAI	OUTSIDE AIR INTAKE
COD	CLEAN OUT DOOR	OED	OPEN END DUCT WITH WMS
CR	CEILING REGISTER	RA	RETURN AIR
CFM	CUBIC FEET OF AIR PER MINUTE	RHC	REHEAT COIL
CUH	CABINET UNIT HEATER	RTU	ROOFTOP UNIT
DSD	DUCT MOUNTED SMOKE DETECTOR	SD	SMOKE DAMPER AND ACCESS DOOR
EDH	ELECTRIC DUCT HEATER	SPD	FIRE SMOKE DAMPER USED FOR SMOKE PURGE
EUH	ELECTRIC UNIT HEATER	SMUA	MAKE UP AIR FOR SMOKE PURGE SYSTEM
EA	EXHAUST AIR	SPX	SMOKE PURGE EXHAUST AIR
EL	ELEVATION	ST	SOUND ATTENUATOR
FD	FIRE DAMPER AND ACCESS DOOR	SX	SMOKE EXHAUST
FSD	FIRE SMOKE DAMPER AND ACCESS DOOR	SWEH	SIDE WALL ELECTRIC HEATER
FC	FLEXIBLE CONNECTION	TX	TOILET EXHAUST
FOD	FLAT OVAL DUCT	TW	THERMOMETER WELL
FOS&R	FUEL OIL SUPPLY AND RETURN	TD	TRANSFER DUCT
GPM	GALLONS PER MINUTE	TO	TRANSFER OPENING
GW	GLYCOL WATER	TG	TOP GRILLE
GX	GENERAL EXHAUST	TR	TOP REGISTER
HC	HEATING COIL	TRG	TRANSFER GRILLE
HV	HEATING AND VENTILATING UNIT	TRR	TRANSFER REGISTER
HWR	HOT WATER RETURN	TN	TOP NECK
HWS	HOT WATER SUPPLY	UH	UNIT HEATER
KE	KILN EXHAUST	VAV	VARIABLE AIR VOLUME
KX	KITCHEN EXHAUST	WMS	WIRE MESH SCREEN

MECHANICAL

SUMMARY

MECHANICAL SYSTEMS, SERVICE SYSTEMS AND EQUIPMENT

THERMAL ZONE

ZONE: 4A
WINTER DRY BULB: 16°F
SUMMER DRY BULB: 93°F

INTERIOR DESIGN CONDITIONS

WINTER DRY BULB: 70°F +/- 3°F
SUMMER DRY BULB: 74°F +/- 3°F
COOLING RELATIVE HUMIDITY: 50% +/- 15%
HEATING RELATIVE HUMIDITY: N/A

BUILDING HEATING LOAD: 947.4 MBH

BUILDING COOLING LOAD: 3311.4 MBH

MECHANICAL SPACING CONDITIONING SYSTEM

UNITARY
DESCRIPTION OF UNIT: DX COOLED HEAT PUMPS WITH ELECTRIC REHEAT VAV
HEATING EFFICIENCY: SEE EQUIPMENT SCHEDULES OR EXISTING
COOLING EFFICIENCY: SEE EQUIPMENT SCHEDULES OR EXISTING
SIZE CATEGORY OF UNIT: SEE EQUIPMENT SCHEDULES OR EXISTING

BOILER
SIZE CATEGORY. IF OVERSIZED, STATE REASON.: N/A

CHILLER
SIZE CATEGORY. IF OVERSIZED, STATE REASON.: N/A

LIST EQUIPMENT EFFICIENCIES: (SEE EQUIPMENT SCHEDULES)

MECHANICAL GENERAL NOTES

1. DESIGN DRAWINGS ARE TO BE CONSIDERED DIAGRAMMATIC. OFFSETS MAY BE REQUIRED TO AVOID EXISTING SERVICES, OTHER TRADES, ETC. COORDINATE WORK WITH ALL TRADES AND FIELD CONDITIONS
2. CX SERVICES TO BE RETAINED BY DTCC
3. ALL LAB EXHAUST DUCTS SHALL BE CONSTRUCTED OF APPROVED G90 GALVANIZED SHEET STEEL WITH MINIMUM 14 GAGE (0.079 INCHES THICKNESS), UNLESS OTHERWISE SPECIFIED. ALL FUME HOOD EXHAUST DUCTWORK SHALL BE MINIMUM 18 GAUGE WELDED STAINLESS STEEL FROM THE FUME HOOD TO THE MAIN EXHAUST DUCT
4. LOCATIONS OF NEW UTILITIES ARE GENERALLY SCHEMATIC. CONTRACTOR SHALL COORDINATE ALL NEW UTILITIES, SERVICES, ETC. WITH EXISTING STRUCTURAL AND ARCHITECTURAL DRAWINGS AND PROVIDE ALL OFFSETS AS REQUIRED
5. CONTRACTOR IS RESPONSIBLE FOR MAINTAINING AND RESTORING THE CONTINUITY OF ALL EXISTING SYSTEMS AFFECTED. INCLUDING BUT NOT LIMITED TO: INSULATION, VAPOR BARRIER, VALVES, CAPS, ETC
6. SUBMIT SHOP DRAWINGS OF ALL WORK WHICH MUST BE APPROVED BY THE ARCHITECT AND ENGINEER BEFORE WORK COMMENCES OR ITEMS ORDERED
7. COORDINATE ALL EQUIPMENT REQUIREMENTS WITH APPROPRIATE TRADES (I.E., CONDENSATE PUMPS COORDINATED WITH ELECTRICAL, PLUMBING, ATC, ETC.)
8. VERIFY AND COORDINATE ALL EQUIPMENT ACCESS AND CLEARANCES WITH THE ARCHITECT, GENERAL CONTRACTOR, AND/OR CONSTRUCTION MANAGER.
9. LOCATE ALL DUCT VOLUME DAMPERS ABOVE ACCESSIBLE LOCATIONS. PROVIDE REMOTE CABLE OPERATED VOLUME DAMPERS WITH THE OPERATOR ACCESSIBLE VIA THE AIR OUTLET WHEN BRANCH DUCTWORK IS LOCATED WITHIN AN INACCESSIBLE LOCATION
10. ALL EXPOSED DUCTWORK SHALL BE INTERNALLY LINED, SEE SPECIFICATIONS
11. CONTRACTOR SHALL BE RESPONSIBLE FOR THE WORK WITH ITS COMPLETION AND FINAL ACCEPTANCE AND SHALL REPLACE ANY OF SAME WHICH MAY BE DAMAGED, LOST OR STOLEN WITHOUT ADDITIONAL COST TO OWNER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPLACING OR REPAIRING ANY BUILDING SYSTEM THAT SERVES OTHER AREAS THAT ARE DAMAGED OR IMPROPERLY MOVED AS A RESULT OF THE WORK.
12. BALANCE ALL AIR OUTLETS TO THE CFM INDICATED ON THE PLANS
13. ALL CONNECTIONS TO SUPPLY DUCTS AND CEILING DIFFUSERS SHALL BE AIR TIGHT AND SEALED WITH WATER BASED SEALANT
14. ALL DUCT SIZES NOTED INDICATE THE CLEAR INSIDE DIMENSIONS OF DUCTWORK. SHEET METAL DIMENSIONS SHALL BE INCREASED WHERE DUCTWORK IS LINED INTERNALLY
15. PROVIDE ALL REMOVABLE ACCESS TILES IN HUNG CEILING FOR ACCESS TO ALL VOLUME AND FIRE DAMPERS (EXISTING OR NEW) AND ALL OTHER MECHANICAL AND ELECTRICAL EQUIPMENT REQUIRING ACCESS FOR MAINTENANCE AND ADJUSTMENTS
16. LOCATE THERMOSTATS AS REQUIRED AND DICTATED BY THE CONSTRUCTION CONDITIONS
17. ALL SUPPLY, RETURN, AND EXHAUST DUCTWORK SHALL BE INSULATED THROUGHOUT. ALL DUCTWORK LOCATED OUTDOORS, ON ROOF SHALL BE INSULATED AND FURTHER WEATHERPROOFED WITH JACKETING

MECHANICAL CODES AND STANDARDS

DESIGN AND PERFORMANCE OF COMPONENTS AND METHODS SPECIFIED HEREIN SHALL COMPLY WITH THE APPLICABLE PROVISIONS OF THE CODES, STANDARDS, AND MANUFACTURER'S RECOMMENDATIONS OF THE ENTITIES LISTED BELOW.

1)	BUILDING	FACILITY MANAGEMENT STANDARDS FOR ALTERATIONS AND CONSTRUCTION
2)	BC	2018 NORTH CAROLINA BUILDING CODE
3)	MC	2018 NORTH CAROLINA MECHANICAL CODE
4)	ECC	2018 NORTH CAROLINA ENERGY CONSERVATION CODE
5)	ASHRAE	AMERICAN SOCIETY OF HEATING, REFRIGERATION AND AIR CONDITIONING ENGINEERS
6)	ASTM	AMERICAN SOCIETY FOR TESTING MATERIALS
7)	ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
8)	UL	UNDERWRITER'S LABORATORIES, INC
9)	FM	FACTORY MUTUAL.
10)	NFPA	NATIONAL FIRE PROTECTION ASSOCIATION.
11)	SMACNA	SHEET METAL AND AIR CONDITIONING CONTRACTOR'S NATIONAL ASSOCIATION.
12)	ASME	AMERICAN SOCIETY OF MECHANICAL ENGINEERS
13)	AMCA	AIR MOVING AND CONDITIONING ASSOCIATION.
14)	ARI	AMERICAN REFRIGERATION INSTITUTE.
15)	MSS	MANUFACTURER'S STANDARDIZATION SOCIETY OF THE VALVE AND FITTING INDUSTRY.

CLIENT AND PROJECT

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NCCCS ID: 2731

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05-07-2025

ISSUE

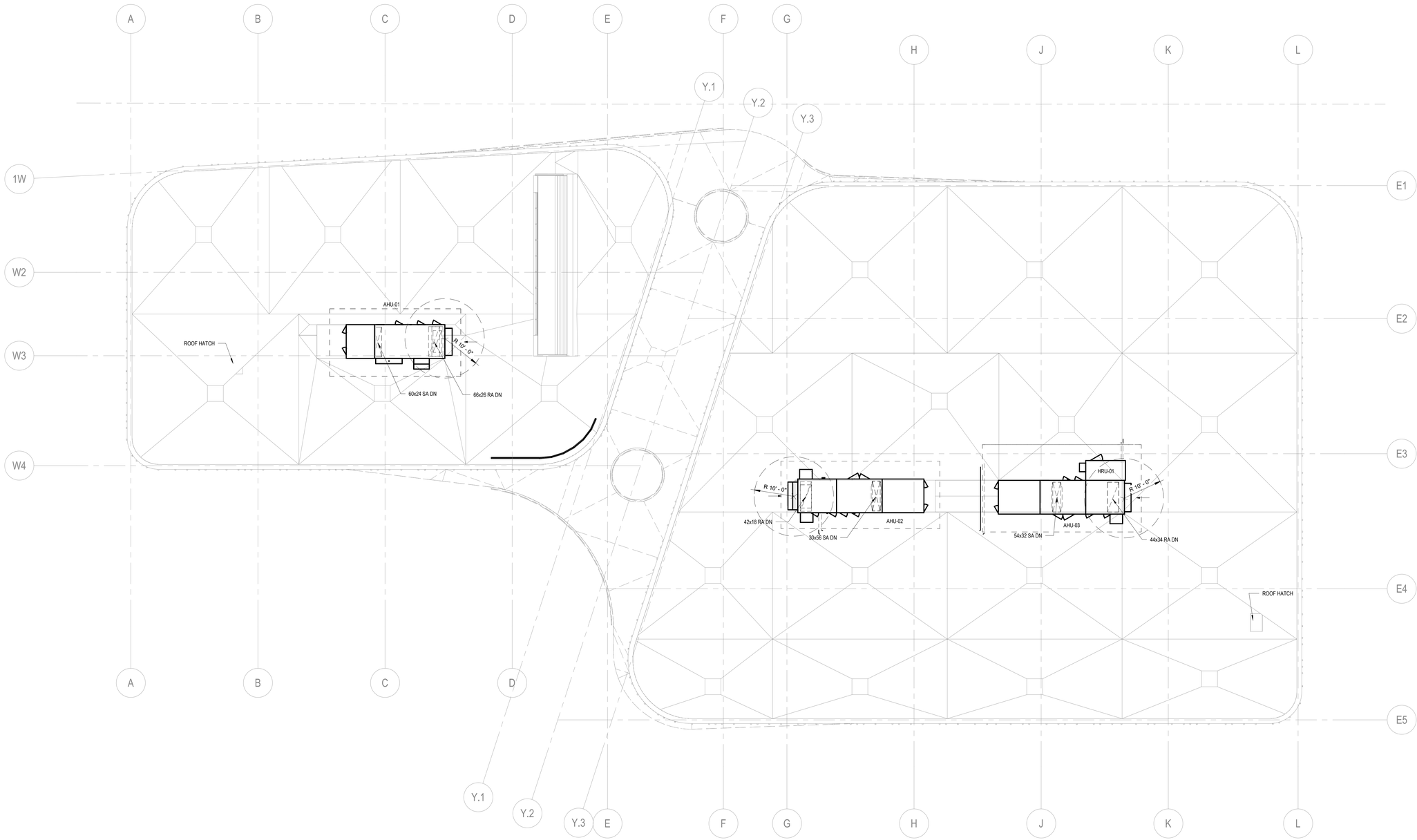
No.	Date	Description

SHEET INFO

EARLY PACKAGE MECHANICAL NOTES, SYMBOLS LIST & ABBREVIATIONS

EP-M001

PROJECT NO: 13774-000
DATE: 05/07/2025
EARLY EQUIPMENT PACKAGE



1 **Mechanical - Roof Level Copy 1**
EP-M202 3/32" = 1'-0"

Scale: 3/32" = 1'-0"
1' 2' 4' 8' 16'

PROJECT NORTH TRUE NORTH

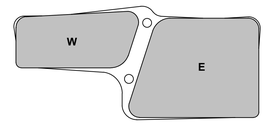
GENERAL NOTES

1. INTEGRATE ALL EQUIPMENT WITH THE CONTROL SYSTEM.
2. ALL EXPOSED EQUIPMENT, PIPING, DUCTWORK, ETC. SHALL BE PAINTED. SEE ARCHITECTURAL PLANS AND SPECIFICATIONS FOR COLORS, FINISH, ETC.
3. COORDINATE ACCESS FOR ALL EQUIPMENT, SENSORS, AND DAMPERS WITH ARCHITECTURAL DRAWINGS.
4. MECHANICAL CONTRACTOR TO COORDINATE ALL MECHANICAL LAYOUTS FOR DUCTS AND PIPING. ALSO, COORDINATE WITH ARCHITECTURAL DRAWINGS AND OTHER TRADES. SHEET METAL SHOP DRAWINGS AND COORDINATION DRAWINGS MUST BE PRODUCED AND SUBMITTED FOR REVIEW BY ENGINEER AND OWNER FOR APPROVAL PRIOR TO PROCEEDING WITH ANY FABRICATIONS AND INSTALLATIONS.
5. ALL DUCTWORK LOCATED OUTDOORS, ON ROOF SHALL BE INSULATED AND FURTHER WEATHERPROOFED WITH JACKETING.

WALL TYPE LEGEND

1-HOUR FIRE BARRIER
2-HOUR FIRE BARRIER

KEY PLAN



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No.	Date	Description

SHEET INFO

EARLY PACKAGE MECHANICAL ROOF OVERALL PLAN

EP-M202

PROJECT NO: 13774-000
DATE: 05/07/2025
EARLY EQUIPMENT PACKAGE

5 4 3 2 1

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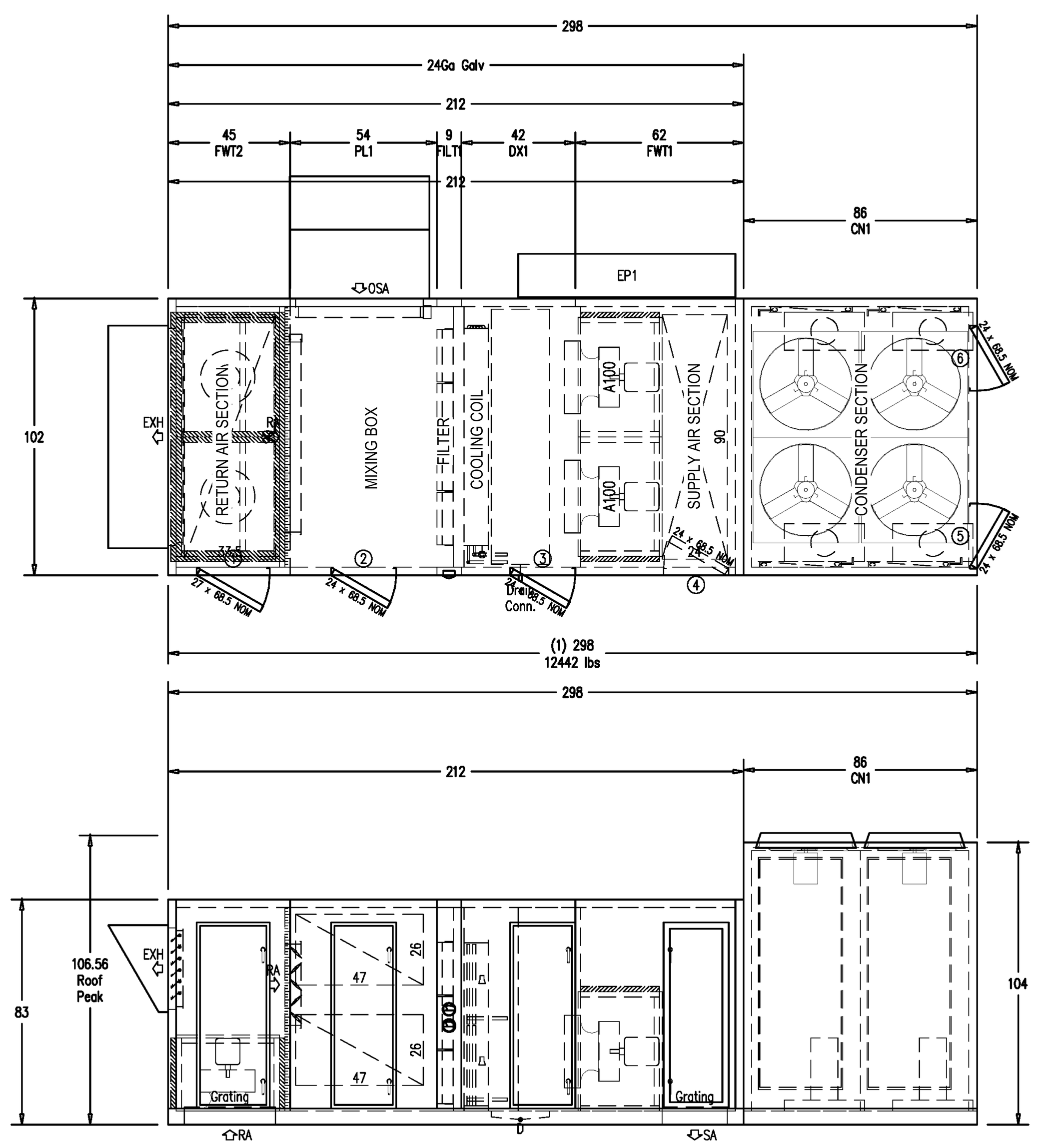

1 TYPICAL AHU-01 ARRANGEMENT Copy 1
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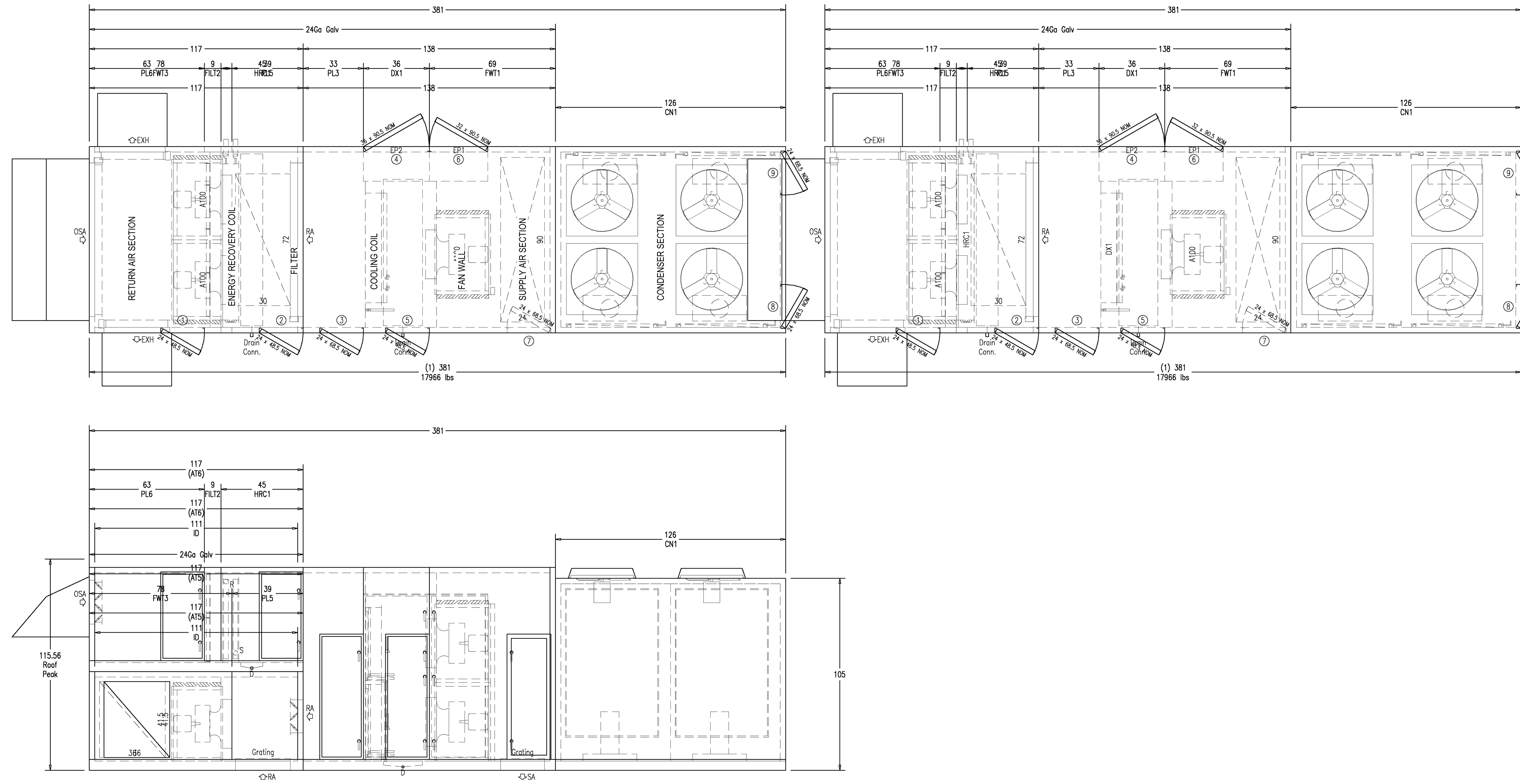

2 TYPICAL AHU-02 ARRANGEMENT Copy 1
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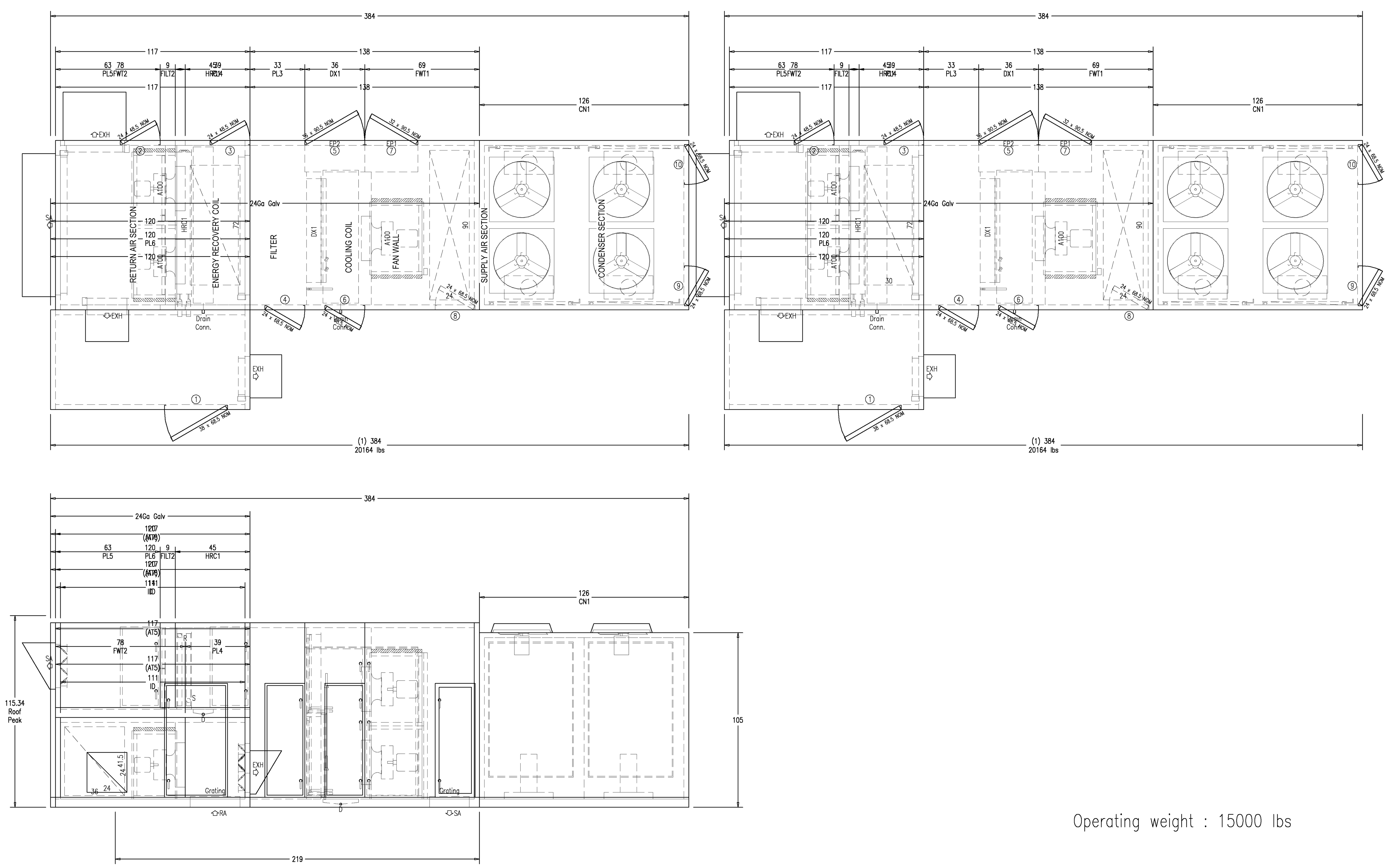
C

B



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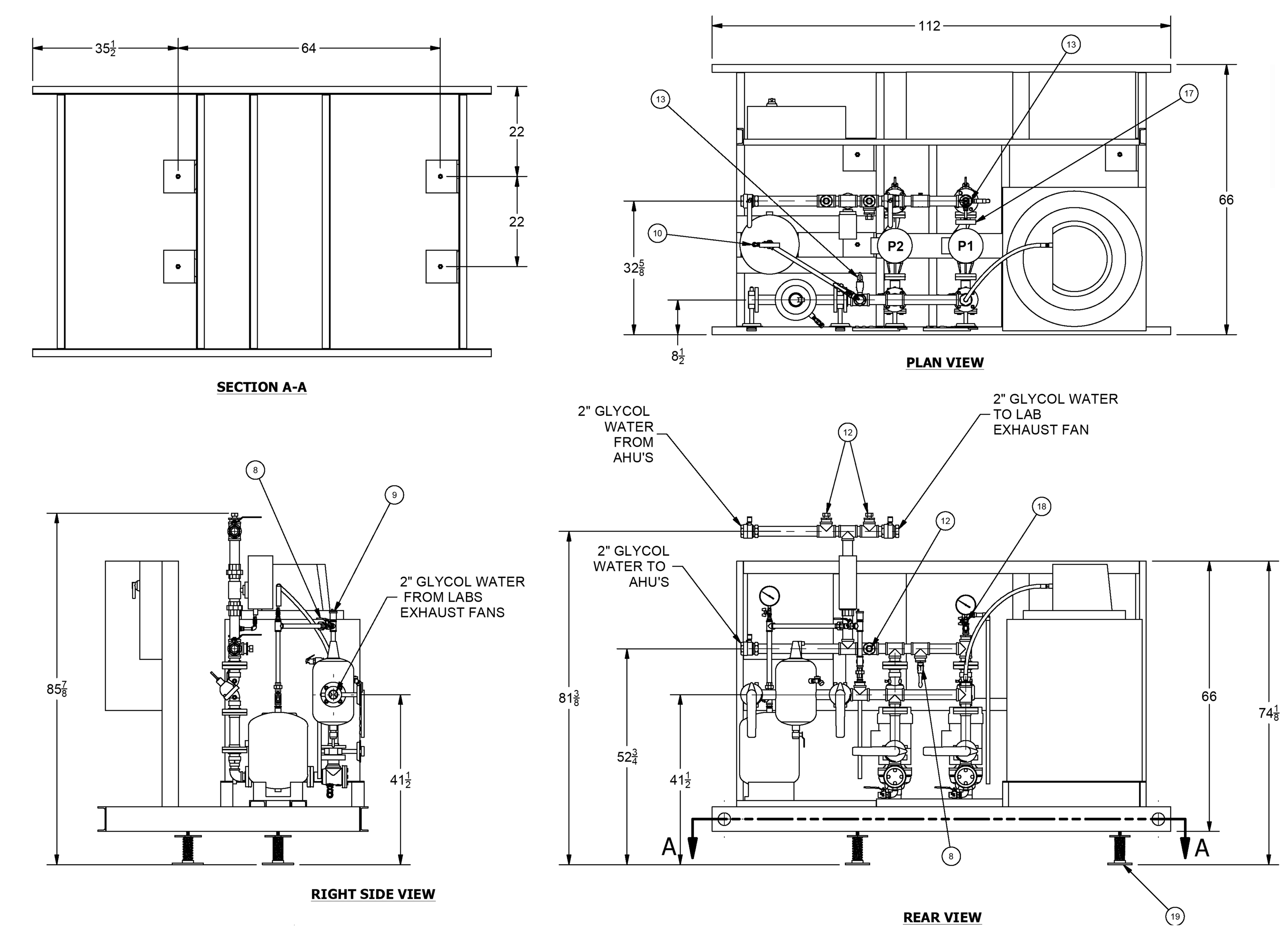

4 HEAT RECOVERY SKID DETAIL Copy 1
N.T.S.

A

5 4 3 2 1

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No.	Date	Description

SHEET INFO

EARLY PACKAGE MECHANICAL DETAILS IV

EP-M404

PROJECT NO: 13774-000
DATE: 05/07/2025
EARLY EQUIPMENT PACKAGE

AHU — ROOF MOUNTED HEAT PUMP AIR HANDLING UNIT SCHEDULE — BASIS OF DESIGN: VENMAR

UNIT NO.	LOCATION	SUPPLY AIR (CFM)	OA (CFM)	SUPPLY FAN DATA					EXHAUST FAN DATA				ENERGY RECOVERY COIL			DX COOLING COIL DATA				HEAT PUMP HEATING			ELECTRICAL DATA			TOTAL WEIGHT (LBS)	MODEL NO.
				QUANTITY	MOTOR HP PER FAN	ESP./TSP (IN. W.G.)	RPM PER FAN	FAN TYPE	QUANTITY	MOTOR HP PER FAN	E.S.P. (IN. W.G.) PER FAN	FAN TYPE	GPM	Heating EWT (°F)	Cooling EWT (°F)	P.D. (FT H20)	TOTAL CAPACITY (MBH)	SENSIBLE CAPACITY (MBH)	FACE VELOCITY (FPM)	EAT (DB/WB °F)	LAT (DB/WB °F)	CAPACITY (KW)	EAT (DB °F)	LAT (DB °F)	V/PH/HZ	FLA / MCA	MOP		
AHU-01	ROOF	13,000	3,910	2	8.5	3.01 / 5.33	2,132	Plenum Fan Wall	2	3.0	1.5	Plenum Fan Wall	-	-	-	-	504	400	350	81/67.4	53/52.9	29.0	10	55	460/3/60	136/142	175	11600	VENMAR
AHU-02	ROOF	13,000	7,755	2	6.5	1.99 / 4.0	1,854	Plenum Fan Wall	2	3.5	1.5	Plenum Fan Wall	30	65.0	80.0	6.0	826	530	350	85/71	53/52.9	41.1	10	55	460/3/60	154/161	200	15400	VENMAR
AHU-03	ROOF	14,000	6,675	2	8.0	3.25 / 5.42	2,088	Plenum Fan Wall	2	3.5	1.5	Plenum Fan Wall	30	65.0	80.0	6.0	755	520	350	83/70	53/52.9	44.0	10	55	460/3/60	173/180	225	15100	VENMAR

NOTES:
1. AIR SOURCE HEAT PUMP USING R454B VARIABLE CAPACITY COMPRESSORS WITH 10:1 TURNDOWN COUPLED WITH VFD HEAD PRESSURE CONTROL INCLUDING 5-YEAR COMPRESSOR WARRANTY.
2. HOT GAS REHEAT CONTROL AS REQUIRED FOR DEHUMIDIFICATION CONTROL
3. UNITS SHALL HAVE VAV UNIT CONTROLLER WITH BACNET MSTP INTERFACE.
4. SA PREMIUM EFFICIENCY FAN MOTORS INVERTER DUTY RATED MOTOR WITH SHAFT GROUNDING RING FOR OPERATION WITH VFD.
5. ECONOMIZER CONTROL WITH FULLY MODULATING OA, RA AND EA DAMPERS AND EXHAUST FANS.
6. SINGLE POINT POWER W/ MAIN DISCONNECT SWITCH & 115V CONVENIENCE OUTLET (FACTORY WIRED).
7. FACTORY MOUNTED AND WIRED VAV CONTROLLER WITH BACNET INTERFACE ABB VFD WITH VAV CONTROLS | DUCT MOUNTED S/A AND DUCT PRESSURE SENSOR FIELD INSTALLED
8. EBTRON OA/RA/SA/EA FLOW MONITORING STATION WITH BACNET INTERFACE (FOUR (4) PER EACH AHU) FURNISHED AND INSTALLED BY THE AHU MANUFACTURER.
9. FAN WALL UTILIZING ABB VFD WITH INVERTER DUTY FAN ASSEMBLIES BALANCED TO BVS IN COPLANAR SILENCERS WITH LOW PRESSURE DROP NON-SPRING BACKDRAFT DAMPERS
10. 3" DOUBLEWALL R12.5 PANELS, 18 GA GALV EXTERIOR WITH 1,000HR SALTSPRAY POLYURETHANE PAINT (COLOR SELECTED BY ARCHITECT) / 24 GA GALV INTERIOR
11. CIRCUIT BREAKER DISCONNECT | 115V CONVENIENCE OUTLET | LIGHT CIRCUIT | PHASE & BROWN OUT PROTECTION
12. SEPARATELY POWERED 115V LIGHTING AND CONVENIENCE OUTLET CIRCUIT SO LIGHTS CAN BE ACTIVATED DURING MAINTENANCE WHEN THE UNIT IS SHUT DOWN
13. FIRE ALARM SHUTDOWN TERMINALS. SMOKE DETECTORS PROVIDED AND INSTALLED BY OTHERS
14. COOLING PERFORMANCE RATED AT 95°F/78°F, HEATING PERFORMANCE RATED AT 20°F O/A
15. AHU-02&03 EQUIPPED WITH ENERGY RECOVERY COIL AND 2" MERV 8 FILTERS TO PROTECT THE COIL
16. 2" MERV 8 PRE-FILTERS WITH FLUSH MOUNTED MAGNEHELIC PRESSURE DIFFERENTIAL DISPLAY
17. 4" MERV 13 UNIT-FILTERS WITH FLUSH MOUNTED MAGNEHELIC PRESSURE DIFFERENTIAL DISPLAY
18. 14" ROOF CURB WITH 1" DEFLECTION SPRING ISOLATION RAIL BY MASON INDUSTRIES
19. PROVIDE UNIT WITH FACTORY AUTHORIZED START-UP AND 1ST YEAR LABOR WARRANTY, INCLUDE 5 YEAR PARTS WARRANTY ON ALL AHU COMPONENTS
20. PROVIDE WITH ONE DAY MANUFACTURER REP SUPPORT FOR FUNCTIONAL PERFORMANCE TESTING DURING COMMISSIONING.
21. PROVIDE 1 DAY OF OWNERS TRAINING
22. WHEN BUILDING IS ON STANDBY POWER, AHU-02 AND AHU-03 OA DAMPERS SHALL FAIL IN OPEN POSITION.

HRU — HYDRONIC UNIT MODULE SCHEDULE — BASIS OF DESIGN: INSIGHT

EQUIP. TAG	LOCATION	EQUIPMENT OR SYSTEM SERVED	GPM	TOTAL HEAD (FT.)	MAX P.D. (FT)	FLUID	ELECTRICAL DATA				REMARKS
							VOLT/ PH	FLA	MCA	MOP	
HRU-01	ROOF	AHU-02/AHU-03/EF-03	60	35	8.4	30% PG	460/3	8	11	15	MAXIUM DIMENSIONS: 96"W x 54"D x 60"H

NOTES:
1. SINGLE POINT POWER CONNECTION.
2. PROVIDE FACTORY-TESTED HYDRONIC MODULE INCLUDING ALL MAJOR MECHANICAL COMPONENTS SUCH AS PUMPS, CONTROL VALVES, A FROST PROTECTION BYPASS LINE, VFD'S, AND TEMPERATURE SENSORS.
3. PROVIDE WITH SKID FOR INSTALLATION ON ROOF, NEMA 3R RATED.
4. EACH HYDRONIC MODULE SHALL INCLUDE:
   - A. TWO GLYCOL PUMPS (1 REDUNDANT) WITH VFD'S AND VIBRATION DAMPERS.
   - B. CONTROL VALVES.
   - C. BALANCING VALVES.
   - D. GLYCOL EXPANSION TANK.
   - E. AIRDIRT SEPARATOR.
   - F. CONTROLLER HARDWARE, SOFTWARE, AND ELECTRICAL CABINET.
   - G. ON-SITE STARTUP AND OWNER TRAINING.
   - H. TRANSPORTATION/FREIGHT (FOB DESTINATION).
5. PROVIDE WITH FACTORY START UP.
6. PROVIDE WITH ONE DAY MANUFACTURER REP. SUPPORT FOR FUNCTIONAL PERFORMANCE TESTING.
7. PROVIDE WITH ONE DAY OWNER TRAINING.
8. PUMP SKID TO BE INSTALLED IN A VENTILATED PAINTED (ARCHITECT SELECTED) DOUBLEWALL ENCLOSURE, ATTACHED TO AHU-03.
9. PUMPS TO BE 100% REDUNDANT SELF SENSING STYLE WITH A DIGITAL READ-OUT SHOWING REAL TIME GPM, HEAD AND WATT USAGE
10. PUMPS TO BE POWERED BY ECM MOTORS SIMILAR TO ARMSTRONG DE 4380 INLINE PUMPS
11. AUTOMATIC BALANCE VALVES AND CONTROL VALVES FOR EACH AHU CIRCUIT
12. 2" INLINE COMBINATION AIR & DIRT SEPARATOR WITH BUILT IN MAGNETS AND BLOWDOWN, COMPARABLE TO SPIROTHERM VDR200PFM
13. GLYCOL AUTOFILL UNIT WITH INTERNAL PUMP AND PRESSURE REGULATOR SET TO 15PSI. 12SPSI WORKING PRESSURE, 55 GALLON TANK CAPACITY
14. HEAT RECOVERY TOUCH SCREEN CONTROLLER WITH GRAPHIC SHOWING WATER SUPPLY & RETURN TEMPERATURES, GPM, EXHAUST AIR TEMPERATURE, OUTSIDE AIR TEMPERATURE AND ENERGY RECOVERED
15. SINGLE POWER POINT PANEL WITH DISCONNECT SWITCHES FOR (2) 460V PUMPS, (1) 120V CONTROLLER, (1) 120V GLYCOL PUMP FEEDER & (1) 120V LIGHT CIRCUIT
16. FACTORY START-UP, BACNET INTEGRATION WITH BMS AND COMMISSIONING

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SHEET INFO

EARLY PACKAGE MECHANICAL SCHEDULES

EP-M501

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DATE: 05/07/2025
EARLY EQUIPMENT PACKAGE

11. TO EQUALIZE FAN RUN TIME, THE EXHAUST FAN CONTROL SEQUENCE SHALL MAINTAIN AN HOUR OF ACCUMULATED RUN TIME TABULATION FOR EACH EXHAUST FAN. WHENEVER THE EXHAUST FAN CONTROL SEQUENCE NEEDS TO START AN EXHAUST FAN AND FANS ARE OFF, IT SHALL START THE EXHAUST FAN WITH THE LOWEST NUMBER OF TOTAL OPERATING HOURS. . WHENEVER A FAN WITH THE HIGHEST AMOUNT OF RUN TIME IS SHUT DOWN, THE CONTROL SYSTEM SHALL ASSIGN THAT FAN AS THE STANDBY FAN. EACH INDIVIDUAL FAN'S RUN TIME HOURS MAY BE MANUALLY RESET FROM AN OPERATOR'S TERMINAL ON THE BMS. RUNNING FAN FOR ANIMAL EXHAUST SYSTEM SHALL BE ROTATED ON A WEEKLY BASIS.
12. UPON THE OCCURRENCE OF AN EXHAUST FAN FAILURE ALARM (WHICH SHALL BE INDICATED AT THE OPERATOR WORKSTATION), THE STANDBY EXHAUST FAN SHALL BE AUTOMATICALLY COMMANDED ON IN ACCORD WITH THE EXHAUST FAN STARTUP SEQUENCE.

8. EMERGENCY/STANDBY POWER OPERATIONS

A. DURING A LOSS IN NORMAL POWER AS INDICATED BY A CONTACT FROM THE EMERGENCY GENERATOR, THE FOLLOWING SHALL OCCUR:
1. LABORATORY EXHAUST FANS SHALL OPERATE AT ROUGHLY 50% CAPACITY AND ASSOCIATED SUPPLY AIR SYSTEMS SHALL OPERATE AT ROUGHLY 50% CAPACITY.
2. FUME HOODS SHALL CONTINUE TO OPERATE IN THEIR NORMAL OPERATING MODE.
3. ALL LABS SHALL EXHAUST AT THEIR MINIMUM (NON-OCCUPIED) FLOW RATES.
4. UNIT HEATRS SHALL STAY ON.
5. LABORATORY CONTROLS SYSTEMS SHALL ENSURE THAT THE PROPER PRESSURIZATION IS MAINTAINED IN EACH LAB.
6. AHU-02 AND AHU-03 OA DAMPERS SHALL FAIL OPEN, TO FACILTATE MAKE UP AIR DRAW THROUGH.
7. TERMINAL UNITS IN EAST WING SHALL FAIL OPEN.
8. OFFICE HVAC SYSTEMS SHALL BE OFF.

B. UPON A RESTORATION OF NORMAL POWER AS INDICATED BY A CONTACT FROM THE EMERGENCY GENERATOR, THE SYSTEM SHALL RESUME NORMAL OPERATION.

9. SUPPLEMENTAL AC UNITS

A. AC UNITS SHALL RUN 24 X 7 DAYS A WEEK AND SHALL BE UNDER THE CONTROL OF THE AC UNIT CONTROLLER.

B. STATUS OF AC UNITS SHALL BE MONITORED AT BAS.

C. GENERAL ALARM SHALL BE MONITORED AT BAS.

D. PROVIDE SEPARATE ROOM TEMPERATURE SENSOR AND CONTROLLER TO MONITOR ROOM TEMPERATURE FOR ALARM.

E. LEAK DETECTOR IN DRAIN PAN SHALL SHUT DOWN UNIT AND COMMUNICATE AN ALARM AT THE BMS UPON SENSING WATER.

10. TYPICAL GENERAL EXHAUST FAN CONTROL

A. WHEN THE EXHAUST FAN IS OFF, ITS ASSOCIATED SPILL AIR DAMPER OR INTAKE DAMPER SHALL BE CLOSED. WHEN THE EXHAUST FAN IS ON, ITS ASSOCIATED DAMPERS SHALL OPEN.

B. START/STOP PROGRAMMING OF ALL SUCH FANS SHALL BE PROGRAMMABLE FROM THE BAS.

C. WHEN THE FANS ARE SHUT DOWN BY THE FIRE ALARM SYSTEM, ITS ASSOCIATED MOTORIZED DAMPERS SHALL BE CLOSED.

11. UNIT HEATERS AND CABINET HEATERS

A. FOR EACH UNIT HEATER, A LINE VOLTAGE ELECTRIC THERMOSTAT SHALL START AND STOP THE UNIT MOTOR AND ENGAGE HEATER TO MAINTAIN AN ADJUSTABLE SPACE TEMPERATURE. AN AUTOMATIC CONTROL SHALL DEENERGIZE THE HEATING ELEMENT THROUGH UNIT HEATER WHEN MOTOR IS OFF.

12. NIGHT SET-BACK MODE FOR ALL HVAC SYSTEMS

A. A SPACE THERMOSTAT SHALL CYCLE SUPPLY AND RETURN FAN OF EACH UNIT TO MAINTAIN THERMOSTAT'S SETTING WHENEVER THE AC SYSTEM IS NOT RUNNING BUT THE SPACE TEMPERATURE FALLS BELOW 50°F. WHEN RUNNING UNDER THIS MODE, THE OUTSIDE AIR DAMPERS SHALL STAY CLOSED AND REHEAT COILS ACTIVE.

13. REFRIGERANT MITIGATION MODE

A. WHEN A REFRIGERANT LEAK IS DETECTED IN ANY OF THE ROOF TOP UNITS, ASSOCIATED TERMINAL UNITS SHALL:
1. UPON MITIGATION ACTIVATION, THE VARIABLE AIR SYSTEM (VAS) APPLICATION IN THE BAS WILL OVERRIDE ALL IDENTIFIED VAV MEMBERS TO FULLY OPEN DURING MITIGATION WHILE DISABLING ELECTRIC HEAT IN ANY VAV TERMINALS EQUIPPED WITH IT.HAND — VFD OUTPUT IS MANUALLY CONTROLLED VIA SPEED SELECTOR INPUT ON DRIVE.
2. IN OCCUPIED MODE, THE VAS WILL RELEASE ALL OVERRIDES ONCE THE MITIGATION ACTION HAS CONCLUDED.
3. DIN UNOCCUPIED MODE, AFTER THE MITIGATION ACTION HAS CONCLUDED, THE VAS APPLICATION WILL RELEASE ALL OVERRIDES, EXCEPT FOR THE DESIGNATED BOXES THAT REMAIN OVERRIDDEN IN UNOCCUPIED MODE IN PREPARATION FOR FUTURE LEAK DETECTION AND MITIGATION.

14. VARIABLE FREQUENCY DRIVES (VFD)

A. VFD'S SHALL HAVE FULL COMMUNICATION CAPABILITIES WITH THE BAS. PROVIDE ALL INTERFACES, GATEWAYS, ETC. AS REQUIRED FOR COMMUNICATIONS BETWEEN THE VFD'S AND BAS.

B. VFD'S SHALL HAVE FOUR DISTRICT MODES OF OPERATION:
1. OFF — VFD AND MOTOR ARE OFF.
2. HAND — VFD OUTPUT IS MANUALLY CONTROLLED VIA SPEED SELECTOR INPUT ON DRIVE.
3. AUTO — VFD OUTPUT IS CONTROLLED BY BAS.
4. BYPASS — DRIVE ELECTRONICS ARE BYPASSED AND UNIT ACTS AS AN ACROSS-THE-LINE-STARTER OPERATING AT 100% SPEED. THIS ALLOWS FOR MAINTENANCE OF DRIVE WHILE MOTOR IS STILL OPERATING.

AHU CONTROLLER SEQUENCE OF OPERATION

1. COMMUNICATION PROTOCOL:

A. BACNET OVER PRIMARY/SECONDARY TOKEN PASSING (MSTP)

2. UNIT STARTUP:

A. WHEN THE UNIT IS IN AN UNOCCUPIED STATE THE SUPPLY IS OFF, THE OUTSIDE AIR DAMPER IS CLOSED AND THE RETURN AIR DAMPER IS OPEN.

B. WHEN THE UNIT IS SWITCHED INTO AN OCCUPIED STATE, THE SUPPLY FAN IS HELD TO A MINIMUM SPEED UNTIL ITS RUNNING STATUS HAVE BEEN PROVEN. ONCE THE STATUS HAVE BEEN PROVEN, THE SUPPLY FAN SPEED WILL BE MODULATED BY THE STATIC PRESSURE CONTROL PROGRAM.

3. AIRFLOW CONTROL:

A. SUPPLY FAN CONTROL: THE SUPPLY FAN SPEED WILL BE CONTROLLED TO MAINTAIN A DUCT STATIC SETPOINT BY USING A DUCT STATIC PRESSURE TRANSDUCER. THE STATIC PRESSURE PROBE IS FIELD MOUNTED 2/3 DOWN THE LONGEST DUCT TRUNK.

B. UNIT PRESSURE LIMIT CONTROL: THE UNIT HAS ALSO BEEN PROVIDED WITH A MECHANICAL HIGH UNIT STATIC PRESSURE SWITCH (3.5" W.C., ADJ.), TO PROTECT THE UNIT FROM OVER PRESSURIZATION.

4. VENTILATION CONTROL:

A. MINIMUM OUTSIDE AIR CONTROL BASED ON OUTSIDE AIR MONITORING AND DEDICATED MINIMUM OUTSIDE AIR DAMPER

B. THE DEDICATED MINIMUM OUTSIDE AIR DAMPER CONTROL POSITION WILL BE VARIED TO MAINTAIN A MINIMUM AMOUNT OF OUTSIDE AIR

C. IF THE SUPPLY AIR TEMPERATURE SHOULD DROP BELOW THE SUPPLY AIR TEMPERATURE CONTROL SET-POINT AND THE MAXIMUM AVAILABLE HEAT IS BEING USED, THE MINIMUM CONTROL POSITION SET-POINT FOR THE DEDICATED DAMPER WILL BE LOWERED TO MAINTAIN DISCHARGE AIR TEMPERATURE.

5. TEMPARATURE AND HUMIDITY CONTROL :

A. A TEMPERATURE CONTROL PROGRAM RAMPS UP AND DOWN HEATING /ECONOMIZER/ COOLING DEMAND VALUES BY USING THE SUPPLY AIR TEMPERATURE CONTROL SET-POINT AND COMPARING IT WITH A SUPPLY AIR TEMPERATURE SENSOR. THE SUPPLY AIR TEMPERATURE CONTROL SET-POINT IS DETERMINED BY THE SUPPLY AIR SPECIFIED SET-POINT (ADJUSTABLE) AND ANY APPLICABLE RESET.

B. THE FOLLOWING RESET OPTIONS ARE ALL AVAILABLE THROUGH THE KEYPAD. THE OPERATOR MAY CHOOSE ONE OR NONE TO PROVIDE RESET FOR THE SUPPLY AIR TEMPERATURE CONTROL SET-POINT.

a. RESET BASED ON ROOM/RETURN TEMPERATURE *(ROOM OR RETURN AIR TEMPERATURE CONTROL)*

b. THE SUPPLY AIR TEMPERATURE WILL VARY TO MAINTAIN THE ROOM/RETURN TEMPERATURE SETPOINT.

C. COMPRESSOR HEATING

a. THE CONTROLLER IS DESIGNED TO STAGE COMPRESSORS AS A HEAT SOURCE FOR TEMPERING THE INCOMING AIR. THE COMPRESSORS WILL BE CONTROLLED TO MAINTAIN THE SUPPLY AIR TEMPERATURE WITHIN THE HEATING CONTROL DEAD-BAND.

D. AMBIENT EVAPORATOR COIL DEFROST CYCLE

a. THE DEFROST CYCLE WILL BE INITIATED WHEN THE SUCTION PRESSURE IS EQUAL OR LESS THAN THE DEFROST INITIATION SET- POINT. THE CONTROLLER WILL DEFROST A MAXIMUM OF 2 CIRCUITS AT A TIME.

E. DEFROST CYCLE OPERATION

a. STOP CIRCUIT #1-2 CONDENSER FANS.

b. SWITCH REVERSING VALVE #1-2 INTO COOLING

c. AFTER 3 MINUTES (ADJ.) OR WHEN DISCHARGE PRESSURE INCREASES ABOVE 300 PSI FOR 5 SECONDS, SWITCH REVERSING VALVE INTO HEATING

d. REPEAT STEPS 2 TO 4 FOR CIRCUIT #3-4

e. SWITCH THE UNIT INTO NORMAL OPERATION MODE

F. COOLING

a. ONCE THE UNIT IS IN MECHANICAL COOLING, THE CONTROLLER WILL ENABLE/DISABLE/MODULATE A COMPRESSOR DEPENDING ON THE COOLING DEMAND. THE CONTROLLER MONITORS THE ENABLED COMPRESSOR'S SAFETIES. EACH COMPRESSOR IS EQUIPPED WITH A COMPRESSOR MOTOR PROTECTOR AND A LOW AND HIGH HEAD PRESSURE SWITCH.

G. VARIABLE CONDENSER FAN SPEED

a. UNIT SHALL BE EQUIPPED WITH A VARIABLE FREQUENCY DRIVE ON THE CONDENSER FANS, WHICH MODULATES THE CONDENSER FANS SPEED IN ORDER TO MAINTAIN REFRIGERANT HIGH PRESSURE WITHIN OPERATION RANGE.

H. HOT GAS REHEAT CONTROL

a. IF DEHUMIDIFICATION IS REQUIRED, HOT GAS REHEAT WILL BE ENERGIZED. IN APPLICATIONS WHERE CONSTANT DISCHARGE TEMPERATURE IS REQUIRED IN ALL CONDITIONS, UNITS EQUIPPED WITH HOT GAS REHEAT MAY ALSO HAVE A COMPLEMENTARY REHEAT SOURCE FOR PART LOAD CONDITIONS (IN PART LOAD CONDITIONS, HOT GAS REHEAT MAY NOT ALWAYS SUFFICE TO ACHIEVE DESIRED SET-POINT). AN ALGORITHM HAS BEEN PROVIDED TO CONTROL HOT GAS REHEAT AS FIRST STAGE OF REHEAT, ALONG WITH ANY APPLICABLE SUPPLEMENTAL SOURCE OF REHEAT, AS SECOND STAGE.

I. DEHUMIDIFICATION CONTROL

a. IF THE SPACE/ROOM OR RETURN AIR HUMIDITY IS ABOVE SET-POINT OUTSIDE THE DEAD-BAND, THE UNIT'S ECONOMIZER AND COMPRESSORS WILL BE CONTROLLED TO MAINTAIN THE COOLING COIL LEAVING AIR TEMPERATURE AT THE COOLING COIL LEAVING AIR TEMPERATURE SET-POINT. THIS SET-POINT WILL BE SLOWLY LOWERED UNTIL THE HUMIDITY READING IS WITHIN THE DEAD- BAND OR REACHES THE SUPPLY AIR TEMPERATURE SET-POINT WITHOUT RESET (SPECIFIED SET-POINT). ONCE WITHIN THE DEAD- BAND THE COOLING COIL LEAVING AIR TEMPERATURE SET-POINT WILL REMAIN CONSTANT.

b. IF THE HUMIDITY LEVEL DROPS BELOW THE DEAD-BAND, THE COOLING COIL LEAVING AIR TEMPERATURE SET-POINT IS SLOWLY RESET UPWARD UNTIL THE HUMIDITY IS WITHIN THE DEAD-BAND OR THE TEMPERATURE SET-POINT MATCHES THE SUPPLY AIR TEMPERATURE SET-POINT INCLUDING RESET (CONTROL SET-POINT). DURING DEHUMIDIFICATION, THE HEATING SOURCE IS MODULATED/STAGED TO MAINTAIN THE DESIRED SUPPLY AIR TEMPERATURE CONTROL SET-POINT. WHEN THE TWO TEMPERATURE SET-POINTS ARE THE SAME AND THE HUMIDITY LEVEL IS BELOW THE DEAD-BAND, THE SYSTEM WILL RETURN TO NORMAL OPERATION.

6. ECONOMIZER:

A. ECONOMIZER (AIR SIDE ECONOMIZER) : DURING HEATING OPERATION, THE OUTSIDE AIR DAMPER WILL BE AT THE MINIMUM CONTROL POSITION SET-POINT. IN ECONOMIZER OPERATION THE OUTSIDE AIR AND RETURN AIR DAMPERS SHALL OPERATE TO MAINTAIN THE SUPPLY CONTROL SET- POINT. IF ECONOMIZER OPERATION CAN NOT PROVIDE ENOUGH COOLING, THE MECHANICAL COOLING WILL BE ENERGIZED.

B. COMPARATIVE ENTHALPY HIGH LIMIT : THE HIGH LIMIT CONDITION IS BASED ON COMPARING THE RETURN AND THE OUTSIDE AIR ENTHALPY. IF THE OUTSIDE AIR ENTHALPY IS GREATER THAN THE RETURN AIR ENTHALPY, THE ECONOMIZER IS IN A "HIGH LIMIT CONDITION". IN HIGH LIMIT CONDITION, THE ENERGY/HEAT RECOVERY DEVICE IS OPERATING.

7. SUPPLIY AIR TEMPRATURES LIMITS :

A. SUPPLY AIR TEMPERATURE LOW LIMIT : A LOW SUPPLY AIR TEMPERATURE FUNCTION, INTERNAL TO THE CONTROLLER WILL BE PROVIDED TO STOP UNIT OPERATION; IF THE SUPPLY AIR TEMPERATURE IS BELOW SET-POINT (40°± 2°F, ADJ.) FOR LONGER THAN THE TIME SET-POINT (240 SEC, ADJ.).

B. SUPPLY AIR TEMPERATURE HIGH LIMIT : A HIGH SUPPLY AIR TEMPERATURE FUNCTION, INTERNAL TO THE CONTROLLER WILL BE PROVIDED TO SEND A FAULT; IF THE SUPPLY AIR TEMPERATURE IS ABOVE SET-POINT (125°± 2°F, ADJ.) FOR LONGER THAN THE TIME SET-POINT (240 SEC, ADJ.).

8. SAFETIES AND ALARMS:

A. SAFETIES:

a. AUTOMATIC OPERATION: WHEN ALARMED, SMOKE DETECTORS WILL STOP THE SUPPLY AIR FANS. WHEN SMOKE CONDITION IS CLEARED AND DETECTORS ARE RESET, THE SYSTEM RESUMES NORMAL OPERATION.

b. FREEZESTAT OPERATION: THE FREEZESTAT (LOW TEMPERATURE) DETECTORS, ONE FOR EACH PREHEAT COIL, ARE LOCATED DOWNSTREAM OF THE COILS AND SET FOR ACTIVATION AT 35F. UPON ACTIVATION, THE SUPPLY FAN AND (THROUGH SOFTWARE INTERLOCKED) THE RETURN AIR FAN BOTH SHUT DOWN. TO PREVENT NUISANCE FAN SHUTDOWNS, THERE IS A TIME DELAY OF 0-30 SECONDS (ADJUSTABLE) FOR BOTH DETECTORS BEFORE ACTIVATION OCCURS. ONCE THE FANS HAVE BEEN SHUT DOWN, MANUAL RESET, THROUGH A PUSH BUTTON LOCATED AT THE DDC PANEL, IS REQUIRED TO RESTART THEM.

c. STATIC PRESSURE OPERATION: THE SUPPLY FAN SHALL SHUT DOWN UPON A HIGH DISCHARGE PRESSURE OR LOW SUCTION PRESSURE CONDITION AND SHALL STOP THE ASSOCIATED RETURN FAN THROUGH SOFTWARE INTERLOCK. THE RETURN FAN SHALL SHUT DOWN UPON A HIGH DISCHARGE PRESSURE OR LOW SUCTION PRESSURE CONDITION AND SHALL STOP THE ASSOCIATED SUPPLY FAN THROUGH SOFTWARE INTERLOCK. ONCE THE FANS HAVE BEEN SHUT DOWN, MANUAL RESET, THROUGH A PUSH BUTTON LOCATED AT THE DDC PANEL, IS REQUIRED TO RESTART THEM.

B. THE FOLLOWING SAFEITES SHALL DE-ENERGIZE THE SUPPLY FAN AND RELIEF AND RETURN DAMPERS AND CONTROL TO THEIR UNOCCUPIED POSITIONS:

a. LOSS OF POWER
b. INTERNAL DIAGNOSTIC AUTOMATIC SHUTDOWN
c. FIRE ALARM
d. HIGH DISCHARGE STATIC PRESSURE ALARM
e. HIGH INLET NEGATIVE STATIC PRESSURE ALARM
f. FREEZE STAT ALARM

C. ADDITIONAL ALARMS:

g. FILTER LOADING

9. FIRE DEPARTMENT CONTROL CONNECTION:

A. START/STOP FUCTIONS FOR THE AHU SYSTEMS SHALL BE PROVIDED AT THE FIRE ALARM CONTROL PANEL (FACP) TO ALLOW FOR FIRE DEPARTMENT CONTROL OF THE SUPPLY AIR FAN INDEPENDENTLY.

B. START/STOP CONTROL OF THE RELIEF AIR DAMPER SHALL BE PROVIDED AT THE FIRE ALARM CONTROL PANEL TO ALLOW FOR THE FIRE DEPARTMENT CONTROL OF THE FAN.

C. CONTROL'S CONTRACTOR SHALL PROVIDE THE INTERFACE FOR THE FIRE ALARM CONTROL PANEL AND THE BUILDING BMS SYSTEM.

10. ROOM SYSTEM OPERATION:

A. TERMINAL REHEAT UNITS SHOWN SHALL CONTROL SPACE TEMPERATURE BASED ON LOCAL SPACE BY THE THERMOSTAT. DURING NORMAL DAYTIME OPERATION, SUPPLY TERMINAL REHEAT UNIT SHALL OPERATE AS A VARIABLE AIR VOLUME SYSTEM. SUPPLY TERMINAL REHEAR UNIT SHALL MODULATE TERMINAL UNIT CONTROL AND DAMPER TO CONTROL SPACE TEMPERATURE. ON A ROOM TEMPERATURE MEASUREMENTS WHICH IS BELOW THE THERMOSTAT SETPOINT, THE TERMINAL UNIT CONTROL SHALL MODULATE OPEN AND THE TERMINAL UNIT SHALL MODULATE CLOSED TO SATISFY SETPOINT. DAMPER SHALL MODULATE TO ITS MINIMUM SET POINT AND ELECTRIC HEAT SHALL BE ENERGIZED IN STAGES TO MAINTAIN SPACE TEMPERATURE.

B. ALL ROOM THERMOSTATS SHALL BE AND SETPOINT ADJUSTABLE AT THE CENTRAL DDC COMPUTER AND AT EACH ROOM THERMOSTAT THROUGH A DDC CONNECTION. ROOM THERMOSTAT SHALL BE SET BACK TO AN ADJUSTABLE SETPOINT OF 65°F (WINTER) AND (75°F) SUMMER BETWEEN THE HOURS OF 9 P.M. AND 6 A.M. (ADJUSTABLE)

C. WHERE MORE THAN ONE THERMOSTAT IS INTERLOCKED INTO ONE TERMINAL UNIT, THE AVERAGE TEMPERATURE SHALL BE UTILIZED TO CONTROL THE TERMINAL UNIT STATUS OF OPERATION.

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05-07-2025

ISSUE

No.	Date	Description

SHEET INFO

EARLY PACKAGE MECHANICAL SEQUENCES A

EP-M602

PROJECT NO: 13774-000
DATE: 05/07/2025
EARLY EQUIPMENT PACKAGE

HEAT RECOVERY COILS SEQUENCE OF OPERATION (AHU-02, AHU-03, LEF-01)

A. GENERAL:

1. SEE PLANS FOR LOCATIONS OF ALL DAMPERS, AND EQUIPMENT; WHERE SUCH DEVICES ARE NOT INDICATED, BUT ARE REQUIRED BY THE SEQUENCES, THEY SHALL BE PROVIDED BY CONTRACTOR AND LOCATED IN THE FIELD BY THE ENGINEER.

2. ALL TEMPERATURE, PRESSURE, AND TIME SET POINTS SHALL BE FULLY ADJUSTABLE FROM THE BMS.

3. ALL FANS SHALL BE PROVIDED WITH PRESSURE SWITCH AND FILTER BANKS SHALL BE PROVIDED WITH DIFFERENTIAL PRESSURE SENSORS. SWITCHES SHALL PROVIDE STATUS OF FAN OPERATION AND SENSORS SHALL MONITOR FILTER LOADING.

4. THE CONTROL CONTRACTOR SHALL PREPARE AND SUBMIT FOR APPROVAL A COMPOSITE CONTROL AND INTERLOCK WIRING DIAGRAM DEPICTING THE ENERGY RECOVERY VENTILATION SYSTEM AND HIGH PLUME EXHAUST FAN SYSTEM PROVIDED. THE CONTROL CONTRACTOR SHALL BE RESPONSIBLE FOR AND SHALL PROVIDE ALL CONTROL AND INTERLOCK WIRING FOR THE ENTIRE SYSTEM INCLUDING UNIT CONTROL SYSTEM AND COMMUNICATION MODULE PROVIDED BY THE ENERGY RECOVERY VENTILATION UNIT MANUFACTURER AND THE HIGH PLUME EXHAUST FAN SYSTEM MANUFACTURER. DIAGRAMS SHALL CLEARLY SHOW HOW THE ENERGY RECOVERY VENTILATION UNIT AND HIGH PLUME EXHAUST FAN SYSTEM CONTROLS AND OTHER DEVICES WILL BE INTERFACED WITH THE CONTROL SYSTEM.

5. START/STOP CONTROL OF ALL FANS AND ISOLATION DAMPERS SHALL BE PROVIDED THROUGH THE BUILDING MANAGEMENT SYSTEM (BMS) VIA COMMUNICATION INTERFACE WITH THE ENERGY RECOVERY VENTILATOR CONTROL PANELS AND THE HIGH PLUME EXHAUST FAN SYSTEM CONTROL PANEL SHALL CONTROL INTEGRAL START/STOP/SAFETY FUNCTIONS, ENTHALPY WHEEL(S) ROTATION AND HEATING AND COOLING CONTROL OPERATION. PANEL SHALL CONTROL INTEGRAL START/STOP/SAFETY FUNCTIONS, PLENUM BYPASS DAMPER AND EXHAUST DAMPER(S) OPERATION ASSOCIATED WITH EACH INDIVIDUAL FAN. THE BMS VIA COMMUNICATION INTERFACE SHALL PROVIDE ALL STATUS AND ALARM MONITORING FOR EACH SYSTEM COMPONENT AND ALSO INDICATE UNIT DIAGNOSTICS.

6. AT LEAST ONE HIGH PLUME EXHAUST FAN SHALL BE RUNNING TO ENABLE A START COMMAND TO ONE OR BOTH ENERGY RECOVERY VENTILATORS.

B. ENERGY RECOVERY COILS:

1. THIS SEQUENCE IS BASIC GUIDELINE OF MINIMUM REQUIREMENTS FOR A TYPICAL 100% OA AHU WITH A PREHEAT COIL, COOLING COIL, ENERGY RECOVERY UNIT.
2. PROVIDE THE FOLLOWING FOR AIR HANDLING UNIT.
   a. HEATING AND COOLING COIL CONTROL
   b. ENERGY RECOVERY SYSTEM CONTROL
   c. VARIABLE FREQUENCY DRIVE WITH STATIC PRESSURE CONTROL
   d. ISOLATION DAMPER CONTROL

3. SAFETY CONTROL SEQUENCES:
   PROVIDE THE FOLLOWING SAFETY FUNCTIONS.
   a. HIGH STATIC PRESSURE LIMIT: PROVIDE A SEPARATE HIGH STATIC PRESSURE SWITCH (ADJ) TO STOP THE FAN WHEN STATIC PRESSURE RISES ABOVE SETPOINT.
   b. LOW STATIC PRESSURE LIMIT: PROVIDE A SEPARATE LOW STATIC PRESSURE SWITCH (ADJ) TO STOP THE FAN WHEN STATIC PRESSURE DROPS BELOW SET POINT.
   c. SMOKE DETECTORS: SMOKE DETECTORS SHALL BE INSTALLED IN THE SUPPLY AIR DUCT WHERE SHOWN ON THE DRAWINGS TO STOP FAN AND SIGNAL THE FIRE ALARM.
   d. SMOKE DAMPER: PROVIDE SMOKE DAMPERS IN THE SUPPLY AIR DUCT WHERE SHOWN ON THE DRAWINGS. HARDWIRE SMOKE DAMPERS TO CLOSE UPON UNIT SHUTDOWN AND OPEN ON FAN START UP. SMOKE DAMPERS SHALL OPEN/CLOSE WITHOUT BAS SUPPORT.
   e. OUTSIDE AIR ISOLATION DAMPER: PROVIDE OUTSIDE AIR CONTROL DAMPERS IN THE OUTSIDE AIR SECTION WHERE SHOWN ON THE DRAWINGS. HARDWIRE OA CONTROL DAMPER TO CLOSE UPON UNIT SHUTDOWN AND OPEN ON FAN START UP. OA CONTROL DAMPER SHALL OPEN/CLOSE WITHOUT BAS SUPPORT.
   f. FREEZSTAT: PROVIDE LOW TEMPERATURE SAFETY SWITCH DOWNSTREAM OF PRE-HEAT COIL TO STOP THE FAN WHEN PRE-HEAT COIL DISCHARGE TEMPERATURE DROPS BELOW 38°F (ADJ). MANUAL RESET

4. START-STOP SEQUENCES: PROVIDE THE FOLLOWING OPERATIONAL AND INTERLOCK FUNCTIONS WHEN THE AIR HANDLING UNIT FAN IS STARTED OR STOPPED, UNLESS OTHERWISE NOTED. THESE SEQUENCES SHALL BE FUNCTIONAL FOR ANY REASON THE FAN STARTS-STOPS IN ANY MODE OF OPERATION (ALL VFD MODES, ALL AUTOMATIC AND SAFETY FUNCTIONS, AND LOCAL MANUAL START-STOP).
   a. OUTSIDE AIR AND SUPPLY AIR DAMPERS: OPEN OA AND SMOKE DAMPERS TO 100% UPON FAN SIGNAL TO START. IF FAN FAILS TO START WITHIN 60 SECONDS AFTER DAMPERS ARE OPEN, CLOSE DAMPERS AND SIGNAL FAN FAILURE ALARM.
   b. COOLING COIL ASSOCIATED COMPRESSOR: ENABLE COIL ASSOCIATED COMPRESSOR UPON PROOF OF FAN START. DE-ENERGIZE COIL UPON PROOF OF FAN STOP.

5. FAN SPEED CONTROL: PROVIDE STATIC PRESSURE SENSORS MOUNTED ON SUPPLY AIR DUCTS AS INDICATED ON FLOOR PLAN. CONTROL THE VARIABLE SPEED DRIVE TO MAINTAIN THE CALCULATED STATIC PRESSURE SET-POINT. IN THE EVENT THE REMOTE STATIC PRESSURE BECOMES UNRELIABLE, REVERT CONTROL TO THE STATIC PRESSURE SENSOR LOCATED AT THE AHU AND INITIATE AN ALARM.

6. STATIC PRESSURE RESET CONTROL: BAS SHALL POLL THE DAMPER POSITION OF ALL AIR TERMINAL BOXES. IF ALL DAMPERS ARE BELOW 60% AS INDICATED BY COMMAND SIGNAL, THE BAS SHALL RESET THE STATIC PRESSURE SET-POINT DOWN AT A RATE OF -0.1" WG. IF ANY VAV BOX DAMPER COMMAND SIGNAL IS ABOVE 90%, THE BAS SHALL RESET STATIC PRESSURE SET-POINT UP AT A RATE OF +0.25" WG. THE BAS SHALL POLL ALL AIR TERMINALS CONTINUOUSLY AND LIMIT RESET FREQUENCY TO NO MORE THAN ONCE EVERY 15 MINUTES. LIMIT THE RESET TO A MINIMUM STATIC SET POINT AND A MAXIMUM STATIC SET POINT AS DETERMINED BY THE TEST, ADJUST AND BALANCE PROCEDURE.

7. COOLING COIL CONTROL: BAS SHALL MODULATE THE COOLING COIL ASSOCIATED COMPRESSOR AS REQUIRED TO MAINTAIN SUPPLY AIR DISCHARGE AIR TEMPERATURE (AS SENSED DOWNSTREAM OF FAN) SET-POINT OF 55°F (ADJ).PREHEAT COIL CONTROL: BAS SHALL MODULATE THE PREHEAT COIL TO BE ENERGIZED AS REQUIRED TO MAINTAIN PREHEAT AIR TEMPERATURE (AS SENSED DOWNSTREAM OF PREHEAT COIL) SET-POINT OF 50°F (ADJ).

8. ENERGY RECOVERY CONTROL: BAS SHALL ENABLE THE ENERGY RECOVERY WHEEL WHEN THE OUTDOOR AIR TEMPERATURES ARE BELOW 48 DEGF (ADJ) AND ABOVE 75 DEGF (ADJ). THE ENERGY RECOVERY WHEEL SHALL REMAIN OFF AT ALL OTHER CONDITIONS.

9. EXHAUST FAN CONTROL: INTERLOCK THE EXHAUST FAN TO RUN WHENEVER THE SUPPLY FAN IS RUNNING. THE EXHAUST FAN SPEED SHALL RUN IN PARALLEL WITH THE SUPPLY FAN SPEED BUT AT A PREDEFINED OFFSET ESTABLISHED THROUGH THE TEST ADJUST AND BALANCE PROCESS PROCEDURE

6. THE FOLLOWING SAFETIES SHALL DE-ENERGIZE THE SUPPLY FANS, CLOSE CORRESPONDING

   a. HIGH DISCHARGE AIR PRESSURE
   b. LOSS OF POWER
   c. INTERNAL DIAGNOSTIC AUTOMATIC SHUTDOWN

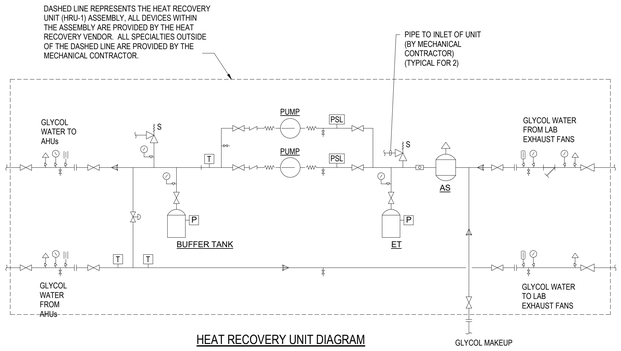
10. ADDITIONAL ALARMS:

   a. FILTER LOADING.

ENERGY RECOVERY UNIT (HRU) RUN-AROUND LOOP COILS SEQUENCE OF OPERATION:

A. THE CONTROLLER SHALL RUN THE RUN-AROUND LOOP PUMP AND MODULATE THE RUN-AROUND LOOP MIXING VALVE FOR ENERGY RECOVERY AS FOLLOWS.

1. COOLING RECOVERY MODE:
   a. THE RUN-AROUND LOOP PUMP SHALL RUN CONTINUOUSLY. THE CONTROLLER SHALL MEASURE THE RUN-AROUND LOOP COIL DISCHARGE AIR TEMPERATURE (DOWNSTREAM OF THE OUTSIDE AIR COIL) AND MODULATE THE RUN-AROUND LOOP MIXING VALVE TO MAINTAIN A SETPOINT 2° F(ADJ) LESS THAN THE UNIT SUPPLY AIR TEMPERATURE SETPOINT. THE RUN-AROUND LOOP SHALL RUN FOR COOL RECOVERY WHENEVER:
      i. UNIT RETURN AIR TEMPERATURE IS 5°F(ADJ) OR MORE BELOW THE OUTSIDE AIR TEMPERATURE.
      ii. AND THE UNIT IS IN A COOLING MODE.
      iii. AND THE ECONOMIZER (IF PRESENT) IS OFF.
      iv. AND THE SUPPLY FAN IS ON.
2. HEATING RECOVERY MODE:
   a. THE RUN-AROUND LOOP PUMP SHALL RUN CONTINUOUSLY. THE CONTROLLER SHALL MEASURE THE RUN-AROUND LOOP COIL DISCHARGE AIR TEMPERATURE (DOWNSTREAM OF THE OUTSIDE AIR COIL) AND MODULATE THE RUN-AROUND LOOP MIXING VALVE TO MAINTAIN A SETPOINT 2°F(ADJ) GREATER THAN THE UNIT SUPPLY AIR TEMPERATURE SETPOINT. THE RUN-AROUND LOOP SHALL RUN FOR HEAT RECOVERY WHENEVER:
      i. UNIT RETURN AIR TEMPERATURE IS 5°F(ADJ.) OR MORE ABOVE THE OUTSIDE AIR TEMPERATURE.
      ii. AND THE UNIT IS IN HEATING MODE.
      iii. AND THE ECONOMIZER (IF PRESENT) IS OFF.
      iv. AND THE SUPPLY FAN IS ON.
3. FROST PROTECTION:
   a. THE RUN-AROUND LOOP PUMP SHALL RUN AND THE RUN-AROUND LOOP MIXING VALVE SHALL CLOSE TO 0%(ADJ.) IN ORDER TO CIRCULATE WATER THROUGH THE RUN-AROUND LOOP EXHAUST AIR COIL WHENEVER:
      I. RUN-AROUND LOOP TEMPERATURE DROPS BELOW 33°F(ADJ)
      II. OR THE EXHAUST AIR TEMPERATURE DROPS BELOW 30°F(ADJ)
4. ALARMS SHALL BE PROVIDED AS FOLLOWS:
   a. RUN-AROUND LOOP PUMP FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
   b. RUN-AROUND LOOP PUMP IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
   c. RUN-AROUND LOOP PUMP RUNTIME EXCEEDED: STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT (ADJ)



HEAT RECOVERY UNIT DIAGRAM

SEQUENCE OF OPERATION MUST MATCH AND MEET OWNER REQUIREMENTS
CONTROLS SUBMITTAL AND CONTROLS SEQUENCE MUST BE SUBMITTED TO OWNER AND ENGINEER FOR APPROVAL PRIOR TO PURCHASING AND IMPLEMENTING

CLIENT AND PROJECT

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